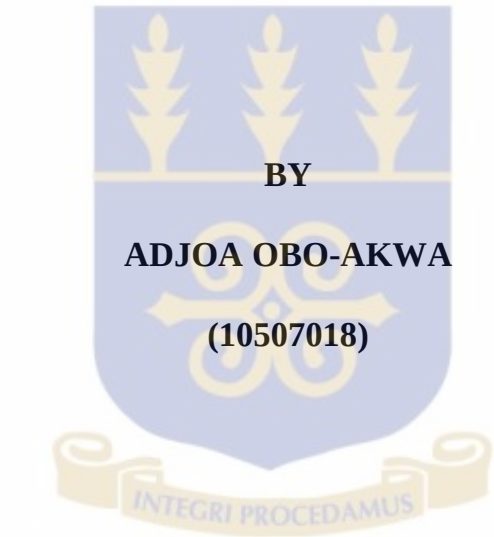
SCHOOL OF PUBLIC HEALTH

COLLEGE OF HEALTH SCIENCES

UNIVERSITY OF GHANA

FACTORS ENHANCING CD4+T-CELL RECOVERY AMONG HIV POSITIVE PATIENTS ON HIGHLY ACTIVE ANTIRETROVIRAL THERAPY FOR ONE YEAR AT THE KORLE-BU TEACHING HOSPITAL, ACCRA.



BY

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DECLARATION

I, Adjoa Obo-Akwa, declare that except for the other studies which have been duly acknowledged, this work is the result of my own original research, and that this dissertation, either in whole or in part has not been presented elsewhere for another degree.

ADJOA OBO-AKWA	DATE
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SUPERVISOR	

DEDICATION

I dedicate this dissertation to Almighty God.

I also dedicate this dissertation to my lovely mother, Madam Isabella Esi Etruba Enyimayew; indeed I have seen the love of a mother during this project period. Thank you mama. I really appreciate every bit of your love towards me. God bless you richly in Jesus' name, Amen.

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ABSTRACT

The Human immunodeficiency virus (HIV), the etiologic agent of Acquired Immunodeficiency Syndrome (AIDS), since it was discovered in 1981, has become a global pandemic, because it acts by breaking down the immune system exposing the infected persons to other diseases and causing high mortalities. Currently, an estimated 34 million of the world populations are infected with the virus and results in millions of deaths around the world. CD4+T-cells (Cluster of Differentiation T-Lymphocyte cells) are part of the white blood cells which play important role in immune defense during an etiologic infection in a host. CD4+T-cells are attacked by the HIV which reduce their numbers. Antiretroviral Therapy (ART) was introduced to reduce the adverse effects of the virus. The ART reduces the viral load and allows the CD4+T- cells to increase.

This study sought to find out the socio-demographic factors of HIV positive patients and the hospital/system factors that enhance CD4+T- cell recovery among clients initiated on the Highly Active Antiretroviral Therapy (HAART) for at least one year.

The study was conducted at the Fevers Unit of the Korle- Bu Teaching Hospital, Accra. HIV positive adult patients managed with HAART for one year participated in the study. Selection was done by random sampling from the computer database. A semi-structured questionnaire was administered, after obtaining informed consent to collect data on the socio-demographics, hospital/system factors and CD4+T-cell counts status of the respondents as well.

A total of 270 respondents participated in the study. The mean age was 44±8.9 years. Males constituted 27% (n=73) and females 73% (n=197). Few of them had tertiary education (6%). Majority, 93% (250/270) of the respondents had medium adherence. Age, sex, educational level and adherence were all found to contribute to CD4+T-cell

recovery and the prevalence of co-infections was 25%. Hospital/system factors, especially the belief that most people will be treated with respect by health care workers if they have HIV/AIDS was associated with CD4+T-cell recovery at p=0.020. All the respondents (100%) were very satisfied with the clinic schedule and waiting time at the clinic while 62% (n=168/270) agreed the service received was just about what was expected.

HIV/AIDS care is very important and HAART reduces the associated morbidity and mortality. The following factors: age, sex, educational level, income level, adherence, residence, doctors/nurses relationship to patients, HAART availability, confidentiality and cost of care were found to impact on enhancing CD4+T-cell recovery.

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LIST OF ABBREVIATIONS

AIDS	Acquired Immunodeficiency Syndrome
ART	Antiretroviral Therapy
ARV	Antiretroviral
cART	Combination Antiretroviral Therapy
CD4+T-Cells	Cluster of Differentiation T-Lymphocyte cells
GAC	Ghana AIDS Commission
HAART	Highly Active Antiretroviral Therapy
HIV	Human Immunodeficiency Virus
KBTH	Korle-Bu Teaching Hospital
NACP	National AIDS/STI Control Program
NGO	Non-Governmental Organization
NHIS	National Health Insurance Scheme
PLHIV	People Living with HIV
STI	Sexually Transmitted Infections
TB	Tuberculosis
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION

1.1 Background

The Human Immunodeficiency Virus (HIV) is the etiologic agent of Acquired Immunodeficiency Syndrome (AIDS). The virus infects the vital organs of the human immune system, alters it and make the infected more vulnerable to infections and diseases and when not checked progresses to AIDS (MNT, 2015). The first AIDS case was reported in Los Angeles, United State of America in June, 1981 (CDC, MMWR, 2001). Around 35 million people are living with HIV/AIDS worldwide in 2013 and 1.5 million people died of AIDS- related deaths in the same year, (WHO,2015). About 23.5 million people are infected in sub-Saharan Africa with the virus.

The first case of AIDS was reported in Ghana in 1986, since then there has been a rise in the number of people, both adults and children infected by HIV ((WHO, 2005, NACP, 2010). The 2013 sentinel survey from the Ghana AIDS Commission (GAC) puts the national prevalence at 1.3% (GAC, 2014).

The HIV and AIDS epidemic remains a threat to the economies of many nations particularly in sub-Saharan Africa, including Ghana. Antiretroviral Therapy (ART) was started in Ghana in 2003 and has proved to be a major lifeline for People Living with HIV (PLHIV) and an important HIV preventive intervention that ensures minimal new infections in the general population (NACP, 2012). The introduction of Highly Active Antiretroviral Therapy (HAART) has resulted in significant decreases in HIV-related morbidity and mortality in both the developed and developing countries (Lartey *et al*., 2014). The World Health Organizations (WHO) guidelines for antiretroviral therapy

initiation were reviewed by the NACP (National AIDS/STI Control Programme) in 2010. The guidelines recommend that HAART should be started when Cluster of Differentiations T-Lymphocyte cell (CD4+T-cell) counts is below 350cells/µl. The CD4+T-cell counts measures the degree of immunosuppression in HIV-positive patients, used as an indicator for the commencement of antiretroviral therapy, in staging the disease and for the determination of treatment failure (Akinbami *et al.*, 2012).

CD4+T-cell counts have been used to monitor the progress of patients initiated on HAART. The monitoring of CD4+T-cell counts and its understanding are a basis for assessing the effectiveness of most HIV treatments and how patients respond to treatment with time.

Even though CD4+ T-cell recovery is observed in patients initiated on ART, quite a number of factors have been shown to affect how the recovery takes place (Crum-Cianflone *et al.*, 2010). The level of CD4+T-cell increase was found to be inversely associated with age (Akinbami *et al*., 2012, Luguterah and Mustapha, 2013 and Semeere *et al.*, 2014).

1.2 Statement of the Problem

The spread of HIV/AIDS can be checked by the initiation of ART among HIV positive patients. Ghana started implementing the WHO guidelines on HAART initiation in 2003 through the Ghana Health Service, Ghana AIDS Commission (GAC) and National AIDS/STI Control Programme. HIV positive patients with low CD4+T-cell counts (< 350c/µl) received a combination antiretroviral therapy (cART) or HAART comprising of

three ART medications from at least two classes of antiretrovirals, currently the recommended treatment for HIV infection for adults and children (Siegfried, 2013) .

A lot of research has been carried out on the outcome of HAART between patients in lower and higher income countries which shows that while on HAART, mortality was higher in low-income countries than those in higher income countries (Dabis *et al.*, 2006). HAART has also been found to suppress the viral load and enhance immunological recovery by increase in CD4+T-cells (Mulu *et al.*, 2014).

In Ghana, studies on factors that affect the treatment of patients on HAART, have also been carried out in the Northern Region by (Luguterah & Adams, 2013) involving the pattern of CD4+T-cell dynamics among patients who have been initiated on HAART and found out that the effectiveness of treatment decreased with time. While marital status and gender did not have any significant effect on the CD4+T-cell counts, religious and educational level of the patients had an effect.

Although the Korle-Bu Teaching Hospital is one of the hospitals which provides medical care and HAART to HIV positive patients, not much research has been done with respect to the factors that enhance CD4+T- cell recovery. Anecdotally the HAART is expected to increase the CD4+T-cell counts of these patients. However, empirical evidence to substantiate this notion is limited.

Patients initiated on HAART, experience more energy, gain weight, better sleep and are motivated to do more physical activity (Collen *et al.*, 1999) as an indication of better immunological recovery due to rise in their CD4+T-cell counts. Even though this is what is normally expected, some patients don't feel any improvement. Quite a number of

factors affect how the CD4+T-cell count increase in patients on HAART. The level of rise or recovery of CD4+T-cell count among those initiated on HAART for at least one year has not yet been determined at the Korle-Bu Teaching Hospital.

This study seeks to find evidence and document the CD4+T-cell recovery, determine the factors that have contributed to the enhancement of immune recovery in patients who are initiated on HAART.

1.3 Conceptual Framework

Generally, when a patient is initiated on HAART, a recovery of the immunological system is expected, depicted by an increase in the CD4+T- cell counts of between 50-150cells/µl, but some patients do not achieve this increase (Gaardbo, *et al*., 2012). There are so many factors which affect the CD4+T-cell increase. These include, but not limited to the socio-demographic factors which include age, sex, educational level, income level, occupation, place of residence, adherence to the drug, disease condition and baseline CD4+T-cell counts at initiation of HAART, and the viral load. There are also hospital/system factors which influence the immune response of the patients initiated on HAART. These include the availability of the HAART, long waiting time at the clinic, confidentiality issues, availability of laboratory reagents and equipment, doctors/nurses relationship to patients, and cost of care.

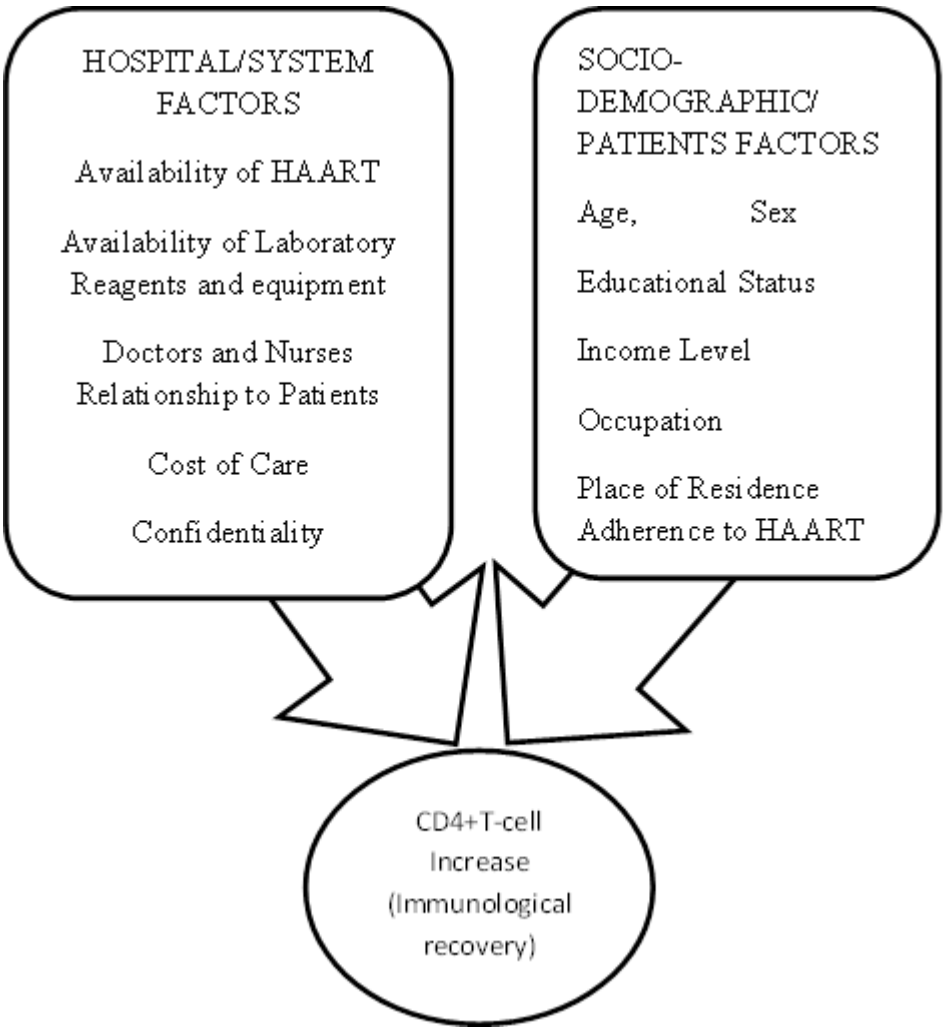

Figure 1: Conceptual Framework showing the effect of socio- demographic patient factors and hospital/system factors on CD4+T-cell recovery

1.4 Justification of the Study

A lot of research has been carried out concerning factors enhancing CD4+T-cells recovery in other hospital facilities. The NACP introduced the HAART combination since 2003 and this research seeks to find out what has been happening to the patients who have been initiated on these HAART according to the WHO guidelines. Generally HAART is supposed to improve the lives of the patients, prolong disease progression to AIDS and wasting syndrome, restore and preserve the immune system of the patients infected by HIV and reduce HIV associated morbidity and mortality among those infected (WHO, 2008). According to the WHO guidelines (WHO, 2008), an adequate response to ART is defined as an increase in CD4+T-cell count in the range of 50-150cells/µl, during the first year of ART. This study seeks to determine rise of CD4+T-cell counts and to identify either the barriers or facilitators which enhance CD4+T-cell recovery among the patients who have been initiated on HAART for one year. This serves as an indicator for monitoring and evaluation of the success of the implementation of HAART in Ghana.

1.5 Objectives

1.5.1 General Objective

The general objective of the study was to assess the factors that enhance CD4+T-cell recovery among HIV positive patients on HAART for one year at the Korle-Bu Teaching Hospital, Accra.

1.5.2 Specific Objectives

The specific objectives are to:

- To determine the socio-demographic factors of patients on HAART for one year.

- To assess adherence to treatment by patients on HAART.
- To identify co-infections among patients on HAART for one year.
- To determine the difference in CD4+T-cell counts from being initiated on treatment to one year of being on HAART among patients at the Korle-Bu Teaching Hospital.
- To determine hospital/system factors that affect the CD4+T-cell recovery among those initiated on HAART for at one year.

CHAPTER TWO

LITERATURE REVIEW

2.1 Global Prevalence of HIV

The HIV, Human Immunodeficiency Virus is a virus from the Retroviridae family of Lenti viruses. When the virus progresses in the individual it causes AIDS and sometimes death. Since its appearance in 1981, the virus has become a global concern because the virus breaks down the immune system of persons infected by it and causes high mortalities.

Globally, it was estimated that 35.2 million people were living with the virus by 2012 (*GLOBAL REPORT*, 2013). Estimated new infections were 2.3 million. The number of AIDS related death also declined to 1.6 million in 2012 from 2.3 million in 2005 (*GLOBAL REPORT*, 2013).

The World Health Organization is working with its developing partners and countries to reduce new infections and to also tackle the HIV/AIDS pandemic as found in the 2011 UN Political Declaration Millennium Development Goal 6 (*GLOBAL REPORT*, 2013). Antiretroviral therapy (ART) is now available and according to the UNAIDS Global Report, (GLOBAL REPORT,2013) the world is almost on the verge of providing antiretroviral therapy to about 15 million people by 2015. In 2012, 9.7 million people in the Low- and Middle- Income Countries received ART representing 61% of those eligible for it in 2010.

In 2013, only 34% of the 28.6 million people who were infected with the virus were able to receive ART in the middle- and low- income countries including Ghana (*GLOBAL*

REPORT, 2013). From 1996-2012, ART has averted 6.6 million mortalities worldwide including 5.5 million in the middle- and low- income countries.

The course of HIV infection has fundamentally changed since the discovery of antiretroviral therapy and fortunately has turned this very serious disease into a chronic condition (Kittner *et al*., 2013).

WHO has been working with many countries and providing guidelines concerning the administration of the antiretroviral therapy. The 2008 guidelines, updated in May 2014 enumerated that two surrogate markers should be used to monitor the ART to show the virologic and immunological efficacy of the ART. The laboratory markers are CD4+T-cell counts and plasma HIVRNA (WHO, 2008).

The HIV/AIDS pandemic in Africa has assumed a dimension that is raising serious concern and calculated efforts among national governments and civil service groups. In Ghana, the HIV/AIDS pandemic is well documented and has gone past not only a health problem but also encompassing all socio-economic aspects of life. The government is working tirelessly with all its developing partners, Non-Governmental Organizations (NGO), donors, civil societies and Ministries to reduce the HIV/AIDS prevalence (Fobil & Soyiri, 2006). In line with combating HIV/AIDS, the Government of Ghana has set up the Ghana AIDS Commission and the NACP (National AIDS/STI Control Programme) which provide technical support, leadership, training and implementation of the strategies to prevent and mitigate the socioeconomic impact on individuals and communities and also to reduce new infections among the 15-49 year group.

The first case of AIDS (Acquired Immunodeficiency Syndrome) was reported in Ghana in 1986, since then there has been a rise in the number of people both adults and children infected by HIV (WHO, 2005; NACP, 2010). Antiretroviral Therapy was started in Ghana in 2003 and has proved to be a major lifeline for PLHIV and an important HIV preventive intervention that ensures minimal new infections in the general populace (NACP, 2012). HIV positive patients are initiated on HAART when the CD4+T-cell counts are less than 350cells/µl. The HAART is made up of three antiviral drugs (2 Nucleoside Reverse Transcriptase Inhibitors and 1 Non-Nucleoside Reverse Transcriptase Inhibitor; 2 Nucleoside Reverse Transcriptase Inhibitors and 1 Protease Inhibitor and 2 Nucleoside Reverse Transcriptase Inhibitors and 2 Protease Inhibitors). The triple drug regimen is to prevent the development of resistance to the medication and also to produce maximum effect against the virus.

Although treatment of HIV infected patients with HAART usually results in diminishing viral replication and increasing CD4+T-cell counts, a reversal of most immunological disturbances and reduction in risk of morbidity and mortality, there is still about 20% who do not attain the optimal immune reconstitution (Gaardbo *et al*., 2012).

Cluster of Differentiation T-Lymphocyte cells are a type of lymphocytes produced in the bone marrow, but mature in the thymus. They play important roles in immune protection during an etiologic infection in a host. During an infection by HIV, the CD4+T-cells help B lymphocyte cells to produce antibodies, induce macrophages, and develop microbicidal activity which in turn recruit neutrophils, eosinophils and basophils. These cells initiate inflammatory reaction and through the production of cytokines and chemokines initiate full response against the virus (Zhu and Paul, 2008). During HIV infection in a host, more

of these CD4+T- cells are destroyed because they are found at the inflammatory sites. However in the course of HAART, the combination effect of Non-nucleoside Reverse-Transcriptase, Nucleoside Reverse Transcriptase and Protease Inhibitors disrupts the replication cycles of the viruses and so the CD4+T-cells become free, hence their numbers increase which translate into immunological response for the patients. Quite a number of studies have shown that there are some factors that allow the CD4+T-cells to increase when patients are initiated on HAART. The WHO guidelines define CD4+T-cell counts in the range of 50 – 150 cells/µl during the first year of ART as adequate response to ART (WHO, 2008).

2.2 Factors contributing to enhanced CD4+T-cell recovery among those initiated on HAART

2.2.1 Socio-demographic/patient factors

Age affects CD4+T-cell recovery, as younger and middle aged patients responded to treatment better than older patients (Annison *et al*.,2013; Semeere *et al.*, 2014,) People > 50 years had 7.55% increase of CD4+T- cells while those of 31-50 years had 36.5% increase (Akinbami *et al*., 2012). A study by Luguterah & Adams (2013) showed that the level of education had an impact on the CD4+T-cell counts as those with tertiary education showed increase in CD4+T-cell counts compared with those of lower level of education.

Based on these factors enumerated above which seem to have an effect on CD4+T-cell recovery when patients are initiated on HAART, this research seeks to find out the factors that have influenced increased CD4+T-cell counts among HIV positive patients attending clinic at the Korle-Bu Teaching Hospital who have been on HAART for one year.

2.2.1.1 Age:

Age affects CD4+T-cell recovery, as younger and middle aged patients responded to treatment better than older patients (Annison & *et al.*, 2013; Semeere *et al.*, 2014,) and increase in CD4+T-cell counts was reached faster in younger age group (Viard *et al*.,2001). People > 50 years had 7.55% increase of CD4+T- cells while those of 31-50 years had 36.5% increase (Akinbami *et al*., 2012).

2.2.1.2 Sex: The female sex tends to have enhanced immunological response than men according to a study in rural South Africa by Malaza *et al.*, (2013). The study found women to have higher CD4+T-cell counts than men.

2.2.1.3. Educational level: A study carried out by Luguterah and Adams (2013); found out that patients with tertiary education had better CD4+T-cell counts than those of lower level of education.

2.2.1.4. Income level: It is expected that patients with higher level of income will take care of themselves better than people with lower income level. HAART improves the immune system and will help the infected patients remain in employment (Howley *et al*., 2010).

2.2.1.5. Adherence to the HAART: This plays a very vital and significant role in the immune recovery process for the patients. It ensures viral suppression, decrease risk of disease progression and reduces drug resistance (Rougemont *et al*., 2009). The HAART are pills and need to be swallowed at a particular time by the patients. It is expected that

the patients adhere to the HAART. Adherence also measures retention to care for those who are newly diagnosed.

2.2.1.6. Co-infection and CD4 +T-cell counts: The co-infection a patient has also affects the rate of immunological response upon initiation on to HAART. Some patients have disease like Hepatitis B Virus or Cytomegalovirus or Tuberculosis. Jung and Paauw (1998) documented that based on the CD+T-cell counts, there were some diseases associated with the patients like Cytomegalovirus, Kaposi Sarcoma, Cerebral toxoplasmosis, Mycobacterium Avium Complex and Pneumonia. This is because some of the patients present late to the hospital and may have reached advanced stages of the HIV infection. CD4+T-cell counts are not affected by Hepatitis B Virus co-infection (Hoffmann *et al.*, 2008). Those with low CD4+T-cell counts of less than 200c/µl had mortality reduced by 34%, when started on ART and Anti-tuberculosis agents, (Luetkermeyer, 2010).

2.2.2 Hospital/System factors

The hospital/ system factors that enhance CD4+T-cell recovery include: the availability of HAART, doctors and nurses relationship with patients, long waiting time at the clinic, presence of laboratory equipment and reagents, confidentiality and cost of care (Scanlon and Vreeman 2013). All these factors relate in one way or the other to how patients fare when initiated on HAART. Doctors and nurses always have to be available at the clinic to take care of the patients and address their specific issues and needs concerning their health.

The equipment and reagents for conducting laboratory investigations also have to be available. Nakanjako *et al*., (2009) suggested that it is good to optimize care through investing in laboratory tests and equipment as this supports clinical monitoring of patients initiated on HAART. These boost patients' confidence and make them always want to come to the hospital. Laboratory investigations are also important for monitoring the progress or lack thereof.

Dissatisfaction of clinical services can be due to long waiting time at the clinic (Dahab *et al*, 2008). This implies that factors that will encourage long waiting time in the clinics such as overcrowded and overburdened health facilities should be addressed. The cost of care includes other medical expenses such as laboratory tests, antibiotics for other opportunistic infections, Moon *et al*., (2008) and these may pose financial difficulty to patients and may stop them from assessing healthcare services, even though the HAART may be given free by the government.

Confidentiality on the part of healthcare providers is also important. When they are not confidential to the patients, the patients will feel stigmatized and will refuse to come to the hospital again. When these factors are checked adequately and made accessible to the patients, they will enhance CD4+T-cell recovery.

CHAPTER THREE

METHODOLOGY

3.1 Study Design

A cross-sectional study was conducted at the Fevers' unit of Korle-Bu Teaching Hospital. 270 respondents participated in the study.

3.2 The Study Location

The study was undertaken in the Fevers Unit of the Korle-Bu Teaching Hospital in Accra. It is the premier teaching hospital and a referral center. The unit takes care of diagnosis and treatment for HIV/AIDS and all infectious diseases. The unit is made up of the Out Patient Department and the in-patient on the wards. The staff is made up of specialist doctors, nurses, counselors/health educators and laboratory personnel who provide care and support to the patients. The unit has about 19000 registered patients on referrals from other health facilities. As part of the routine care, baseline CD4+T-cell counts test is done together with Full Blood Count. Other laboratory investigations like Liver Function Tests, Kidney Function Tests, Chest X-rays and Sputum Acid fast bacilli (AFB) are requested, but these are done outside the Unit.

The Unit has a very good information management system which captures all the patients' demographic information and updates on the clinical care from their clinical records into a computer system. The clinic runs by the appointment system.

3.3 The Study Population

The study population was made up of adult HIV positive patients attending clinic at the Fevers Unit, Korle-Bu Teaching Hospital (KBTH).

3.3.1 Inclusion Criteria

Adult males and females aged 18years and above who have been initiated on HAART for at least one year were eligible.

3.3.2 Exclusion Criteria

This was made up of those who were not yet 18 years, not yet initiated on HAART or were not yet up to one year on HAART.

3.4: Study Variables

3.4.1 Dependent variable

The dependent variable was CD4+T-cell counts

3.4.2 Independent variables were

1. **Socio-demographic/patient factors:** age, sex, educational level, income level, occupation, place of residence, adherence to HAART and co-infections

2. **Hospital/System factors:** Cost of care, Confidentiality, Availability of laboratory equipment and reagents, Doctors/nurses relationship to patients, Availability of HAART, and Long waiting time at the hospital.

3.5 Sample Size Calculation

The sample size was calculated based on 20% Immunological Non Respondence (Gaardbo *et al*., 2012).

$$n = (z^2 pq)/d^2 = z^2 xpxq/d^2$$

Where **n**=sample size

z=confidence interval $(1.96)^2$

p=probability of Immunological Respondence 80% or 0.80

q=probability of Non-Immunological Respondence 20% or 0.20

d= distance on either side of mean in confidence interval $(0.05)^2$

n= $(1.96)^2$ x0.80x0.20/ $(0.05)^2$

n=0.615/0.0025=246

10% of 246 that will be added 10/100x246=25

Total sample size will be 246+ 25=**271**

3.6 Sampling Methods.

The respondents were selected and labeled from a list generated by the computer using the patient's unique identification number. The first case was selected by simple random sampling after which the remaining 269 numbers were by systematic selection of every second patient. The respondents were invited for enrollment into the study. Non-responding patients were replaced by the next person on the list.

3.7 Data Collection Tools and Techniques

A well-structured questionnaire was administered to the respondents after obtaining informed consent. The completed questionnaire were entered into a database by Excel Spreadsheet. The identification numbers were decoded to protect the respondents' identification. Access to the data was by password only. The completed questionnaire were kept under lock and key in a locked cabinet.

The questionnaire was adapted using several tools as shown in Appendix 1 and 2.

Adherence was adapted from Morisky's Medication Adherence Scale (MMAS-8) Cuevas and Periate (2015), which had a maximum score of 8, with 8 scoring high adherence, medium adherence was a score of 6-7 and low adherence being less than 5. The hospital/system factors were adapted from 2 tool kits:

I. USAID TB Care II: Reducing Delays in Diagnosis, Data Collection Tools to Evaluate the Cause and Frequency of TB Delay (Holschneider, *et al.*, 2011).

II. USAID TB II, Tool Kit to Address Timely TB Case Detection and Treatment (Holschneider, *et al.*, 2013).

The questions were asked using the modified Likert Scales with 5 options of 1-5 in the strengths of strongly agree to strongly disagree with neither as 3 (Sclove, 2001).

3.8. Training of Research Assistants

Research assistants were trained on how to administer the questionnaire. This helped them to give uniformed interpretation to the questions, administer and collect data using the questionnaire.

3.9 Pre-Testing

Questionnaire was pretested at the Ridge Regional Hospital OPD, Accra. This was because Ridge is also an ART center. This was done to check for the acceptability, willingness, time needed, and sequencing of the questions, clarity and accuracy in interpretation of the questions.

3.10 Data Handling and Processing

Physical examination of the final data of the Excel spreadsheet was done and checked for properly entered data, missing or omissions and outliers. Responses were picked at random and cross-checked with the Excel spreadsheet.

3.11 Data Analysis

STATA version 12.0 was used to analyze the data. Frequency tables of socio-demographic dependent and independent variables were generated. Univariate analysis was used to investigate the distribution of all the variables. Logistic regression was used to find the strength of association between the dependent and independent variables.

The outcome was generated by finding the difference in the CD4+T-cell counts at 1 year of initiation on HAART and the CD4+T-cell counts at baseline at the time of initiation. An increase of 50 cells/µl was measured as 0 outcomes while greater than 50cells/µl was measured as 1 outcome. The outcome was used to test for association between the CD4+T-cell counts and the independent variables (WHO, 2008).

3.12. Ethical Consideration

Ethical approval was sought from the Ghana Health Service Ethics Review Committee and permission obtained from Korle-Bu Teaching Hospital. The respondents were assured of strict confidentiality and the research topic was explained to them in English, Twi, Ga and Ewe (where necessary). Informed consent was obtained from the respondents prior to administration of the questionnaire. The signed informed consent forms are being kept in safe place, under lock and key.

3.13 Limitations to the study

Ethical clearance and approval from the Ghana Health Service Ethical Review Committee delayed a bit, so this did not allow the study to start in good time. Permission from the Korle-Bu Teaching Hospital allowing the conduct of the study at the Fever's unit delayed, this reduced the data collection time.

The use of phone numbers to recruit the respondents was hectic as some of the phone numbers were not working or were wrong contacts.

CHAPTER FOUR

RESULTS

4.1. Socio-Demographic Characteristics of Respondents:

A total of 270 respondents participated in the study made up of 27 %(n =73/270) males and 73% (n=197/270) females. The mean age was 44±8.9 years and ranged from 24 to 75 years.

Table 1: Socio-demographic Characteristics of 270 Respondents on HAART at Korle- Bu Teaching Hospital, Accra

Characteristics	Frequency	Percentages (%)
Sex		
Male	73	27.0
Female	197	73.0
Age range(years)*		
<30	10	3.70
30-39	80	29.6
40-49	112	41.4
>50	68	25.2
Marital status		
Single	52	19.3
Married	121	44.8
Widowed	46	17
Divorced/Seperated	51	18.9
Educational Level		
Nil	52	19.3
Primary/JSS	113	41.8
SSS/MLSC/Voc/Tech	91	33.7
Tertiary	14	5.19
Employment Status		
Unemployed	37	13.7
Employed	233	86.3
Income Level (monthly)		
Less than Ghc400	225	83.3
Between GHc400-1000	39	14.4
More than GHc1000	6	6.2
Place of Residence		
Rural	16	5.9
Urban	254	94.1
Total	270	100

JSS = Junior Secondary School
SSS = Senior Secondary School
MLSC= Middle School Leaving Certificate
Voc/Tech = Vocational and Technical Education

*Age range reference: Akinbami *et al.*, (2012)

From the data collected, most of the respondents, 41% (n=112/270) were within the 40-49 age group. Nineteen percent (n=52/270) of the respondents were single, 45% (n=121/270) were married, while 17% (n=46/270) were widowed. On assessing educational level, 42% (n=113/270) of the respondents had basic education at the Primary and Junior Secondary School level. Majority, 86% (n=233/270) of the respondents were employed and majority, 83% (n=225/270) earned less than GHc 400 monthly, while majority of them 94% (n= 254/270) lived in urban areas (Table 1).

4.2: Respondents Clinical Characteristics:

Majority, 67% (n=182/270) of the respondents had registered for the National Health Insurance Scheme (NHIS) in order to assess healthcare. Majority of the respondents were at WHO clinical stages III and IV of HIV/AIDS. Forty–four percent (n=118/270) of the respondents were in WHO stage III whereas 14% (n=34/270) were in WHO stage IV. The main therapy being used by respondents were Combivir/Efavirenz 47 % (n=128/270). The rest were on Combivir/Nevirapine 38% (n=102/270) and Tenofovir/Lamivudine/Efavirenz 11% (n=30/270). The proportion of respondents with other diseases was 25% (n=68/270). The adherence level was very high 93% (250/270) shown in Table 2.

Majority, 94% (n=255/270) of the respondents commuted to the hospital by public transportation while the rest came by private cars. Those respondents who had registered with the NHIS never spent money on medications 36% (n=98/270). Majority, 77% (n=208/270) of them sometimes had money to come to the hospital whereas 20% (n=53/270) always had money to come to the hospital. Table 2 shows the clinical and health characteristics of the respondents.

Table 2: Clinical and Health Service Characteristics of Respondents' on HAART at Korle- Bu Teaching Hospital, Accra

Variables	frequency	Percentages (%)
NHIS		
No	88	32.6
Yes	182	67.4
HIV Stage		
I	45	16.7
II	73	27.0
III	118	43.7
IV	34	12.6
Drug Combination		
Comb/EFV	128	47.4
Comb/NVP	102	37.8
TDF/EFV/3TC	30	11.1
TDF/NVP/3TC	1	0.4
Others	9	3.3
Other disease		
No	202	74.8
Yes	68	25.2
Adherence Level		
Low Adherence	20	7.4
Medium Adherence	250	92.6
Transportation (means)		
Walking	10	3.7
Taxi/Trotro	255	94.4
Private car	5	1.9
Transport Expenses (per each clinic visit)		
< 5GHc	184	68.2
Between 5-10GHc	65	24.1
> 10GHc	21	7.8
Laboratory Expenses (every 6 month)		
Zero	119	44.1
< 5GHc	3	1.1
Between 5-50GHc	45	16.7
> 50GHc	103	38.2
Drug Expenses (per month)		
Never	98	36.3
< 10GHc	50	18.5
>10GHc	122	45.2
Finance (drugs and investigations)		
Never	9	3.3
Sometimes	208	77.0
Always	53	19.6
Total	270	100

4.3. Mean CD4+T-Cell Counts

Eighty-seven percent (n=235/270) of the respondents achieved the increase of greater than 50 cells/µl at one year of being initiated on HAART.

The mean CD4+T-cell counts at baseline of initiation was 155cells/µl with a standard deviation (SD) of 108 and at 95% Confidence interval (CI: 142 to 169 cells/µl) while the mean CD4+T-cell counts at one year of being initiated on HAART was 355cells/µl with a SD of 198 and 95%(CI: 331 - 379 cells/µl) as shown in Table 3.

Table 3: Difference in means of CD4+T-cells at baseline ($CD4_1$+T-cell counts) and at 1 year of initiation of HAART ($CD4_2$+T-cell counts)

CD4+T-cell counts	Observations	Mean (cells/ µl)	Standard Error	Standard Deviation	95% Confidence interval
$CD4_2$ +T-cell count (cells/ µl) After 1 year on HAART	270	355	12	198	331-379
$CD4_1$+T-cell counts (cells/ µl) Baseline	270	155	7	108	142-169
Difference	270	200	10	167	220

P-value <0.0001

H_0=No difference in the means of $CD4_2$+T-cell counts and $CD4_1$+T-cell counts

H_1=There is difference in the means between $CD4_2$+T-cell counts and $CD4_1$+T-cell counts

Conclusion: There is difference between CD4+T-cell counts at baseline and CD4+T-cell counts after one year of HAART (p-value<0.0001)

Where $CD4_1$+T-cell counts = CD4+T-cell counts at baseline

$CD4_2$+T-cell counts = CD4+T-cell counts at 1 year of being initiated on HAART

4.4: Hospital/System factors

4.4.1. Doctors/Nurses relationship to patients

Majority of the respondents agreed/strongly agreed that the healthcare workers were supportive, 99.6% and respectful, 99.3% to people who had HIV/AIDS. They also agreed/strongly agreed that most people believe the healthcare workers will be respectful to people who had HIV/AIDS, 44% (n=119/270); 19 %(n= 50/270) respondents disagreed and 37% (101/270) were not sure, Table 4.

4.4.2. Cost of Care: Majority, 68%, (184/270) of the respondents spent less than GHc 5 for transportation and 44% (119/270) did not spend any money for laboratory expenses, however 38%(n=103/270) spent more than GHc 50. About 45% (n=122) of the respondents spent more than GHc10 on medication while the rest either don't pay at all or spent less than GHc10 shown in Table 2.

4.4.3. Confidentiality: Majority, of the respondents 94 % (n= 253/270) strongly agreed that they were being given the opportunity to ask questions while only 3% (7/270) were not sure of what happened as shown in Table 4. All the respondents 100 %(n=270) agreed/agreed strongly to the clinic schedule.

4.4.4. Availability of laboratory reagents and equipment: Majority, 68% (183/270) of the respondents said yes (reagents were not available) while 32% (n=87/270) said no (reagents were available) as shown in Table 4.

4.4.5. Availability of drugs (HAART): Most, 61% (n=165) of the respondents, said no (there were drugs available) while 39% (n=105) said there were shortage of drugs as shown in Table 4.

4.4.6. Long waiting time at the clinic: At least 95% (n=256/270) agreed/strongly agreed they were satisfied and happy with the waiting time while 62 %(n=168/270) said the service was just about as expected as shown in Table 4.

Table 4: Respondents' Assessment of Hospital /System Characteristics at the Korle-Bu Teaching Hospital, Accra

Variables	Frequency	Percentages (%)
Supportive		
Agree/Strongly agree	269	99.6
Disagree/Strongly disagree	1	0.37
Respectful		
Agree/Strongly agree	268	99.3
Disagree/Strongly disagree	2	0.7
Before Supportive		
Agree/Strongly agree	257	95.2
Disagree/Strongly disagree	5	1.9
Neither	8	3.0
Before Respectful		
Agree/Strongly agree	255	94.4
Disagree/Strongly disagree	6	2.
Neither	9	3.3
Believe		
Agree/Strongly agree	119	44.1
Disagree/Strongly disagree	50	18.5
Neither	101	37.4
Satisfied		
Agree/Strongly agree	256	95.2
Disagree/Strongly disagree	12	4.5
Neither	1	0.4
Happy		
Agree/Strongly agree	265	98.2
Disagree/Strongly disagree	4	1.5
Neither	1	0.4
Service		
Better than expected	94	34.8
About what is expected	168	62.2
Not good as expected	8	3.0
Ask Questions		
Agree/Strongly agree	253	93.7
Disagree/Strongly disagree	10	3.7
Neither	7	2.6
Clinic Schedule		
Agree	270	100
Drugs Available		
Agree/Strongly agree	265	98.2
Disagree/Strongly disagree	5	1.9
Drug Shortage		
No	165	61.1
Yes	105	38.9
Reagent Shortage		
No	87	32.2
Yes	183	67.8
Total	270	100

4.5: Factors associated with CD4+T-cell Recovery

Table 5 shows the socio-demographic factors and CD4+T-cell recovery using the Pearson's Chi^2. Sex, age (age range), marital status, educational level, income level, occupation and place of residence were all not found to be significant with the CD4+T-cell recovery at a p –value of <0.05. At bivariate level, the dependent variable, CD4+T-cell was not significantly associated with sex (p=0.827), age (0.636), educational level (p=0.662) as shown in Table 5. Doctors/nurses relationship to patients, availability of HAART, equipment and reagents, cost of care, confidentiality and long waiting time at the clinic, it was only belief (most people believe they will be treated respectfully by health care providers if they have HIV/AIDS**)** that is doctors/nurses relationship to patients that yielded a significant value of 0.020 (p<0.05) as shown in Tables 6, 7, 8 and 9.

Table 5: Socio-demographic Factors Associated with CD4+T-cell Recovery among Respondents' on HAART at the Korle Bu Teaching Hospital, Accra, 2015.

Variables	Cd4+T-cell counts <50c/µl N (%)	Cd4+T-cell counts>50c/µl N (%)	Frequency & Percentages (%)	Pearson's Chi-square	p-value
Sex					
Male	10(13.7)	63(86.3)	73(27.0)		
Female	25(12.7)	172(87.3)	197(73)	0.05	0.827*
Age range(years)					
<30	0	10(100)	10(3.7)		
30-39	10(12.5)	70(87.5)	80(29.6)	1.71	0.636*
40-49	15(13.4)	97(86.6)	112(41.5)		
>50 years	10(14.7)	58(85.3)	68(25)		
Marital status					
Single	6(11.5)	46(88.5)	52(19.4)		
Married	14(11.6)	107(88.4)	121(44.8)	1.13	0.770*
Widowed	8(17.4)	38(82.6)	46(17.0)		
Divorced/Seperated	7(13.7)	44(86.2)	51(18.9.0		
Educational Level					
Nil	4(7.7)	48(92.3)	52(19.26)		
Primary/JSS	16(14.2)	97(85.8)	113(41.9)	1.59	0.662*
SSS/MLSC/Voc/Tech	13(14.3)	78(85.7)	91(33.7)		
Tertiary	2(14.3)	12(85.7)	14(5.19)		
0ccupation					
Unemployment	5(13.5)	32(82.5)	37(13.7)	0.01	0.915*
Employment	30(12.9)	203(87.1)	233(86.3)		
Income Level (monthly)					
<GHc400	30(13.3)	195(86.7)	225(83.3)		
Between GHc400-1000	3(7.7)	36(92.3)	39(14.4)	3.19	0.202*
>GHc1000	2(33.3)	4(66.7)	6(2.2)		
Place of Residence					
Rural	3(18.8)	13(81.3)	16(5.9)	0.50	0.477*
Urban	32(12.6)	222(87.4)	254(94.1)		
Total			270		

*= not significant at p-value <0.05

Table 6: Clinical and Health Service Factors Associated with CD4+T-cell Recovery among Respondents on HAART at Korle- Bu Teaching Hospital, Accra

Variables	Cd4 <50c/µl N (%)	Cd4>50c/µl N (%)	Frequency & Percentages (%)	CHI^2	p-value
Adherence Level					
Low Adherence	2(10)	18(90)	20(7.4)		
Medium Adherence	33(13.2)	217(86.8)	250(92.6)	0.17	0.682*
Other Disease					
No	24(11.9)	178(88.1)	202(74.8)	0.83	0.362*
Yes	11(16.2)	57(83.8)	68(25.2)		
Transport Expenses(per each clinic)					
<GHc5	29(15.8)	155(84.2)	184(68.2)		
GHc5-10	5(7.7)	60(92.3)	65(24.1)	4.13	0.127*
>GHc10	1(4.8)	20(95.2)	21(7.8)		
Laboratory Expenses(every 6 month)					
Zero	14(11.8)	105(88.2)	119(44.1)		
GHc5-50	5(10.4)	43(89.6)	48(17.8)	1.03	0.597*
>GHc50	16(15.5)	87(84.5)	103(38.2)		
Drug Expenses(per month)					
Never	12(12.2)	86(87.8)	98(36.3)		
<10GHc	10(20)	40(800	50(18.5)	2.81	0.245*
>10GHc	13(12.2)	109(89.3)	122(45.2)		
Finance (drugs and laboratory)					
Never	0	9(100)	9(3.3)		
Sometimes	30(14.4)	178(85.6)	208(77.0)	2.32	0.314*
Always	5(9.4)	48(9.6)	53(19.6)		
Drug Combination					
Comb/EVE	15(11.7)	113(88.3)	128(47.4)		
Comb/NVP	17(16.7)	85(83.3)	102(37.8)	2.65	0.619*
TDF/EFV/3TC	2(6.7)	28(93.3)	30(11.1)		
TDF/NVP/3TC	0	1(100)	1(0.4)		
Others	1(11.1)	8(88.9)	9(3.3)		
Total			270		

*=not significant at p-value <0.05

Table 6 shows the Clinical and Health Service factors associated with CD4+T-cell recovery. There was no significant association between CD4+T-cell recovery and adherence level (p=0.682), other disease, (p=0.362), transport expenses, (p=0.127) laboratory expenses, (p=0.597) drug expenses (p=0.245), finance (p=0.314) and drug combination, (p=0.619).

Table 7: Socio-demographic Factors Associated with CD4+T-cell Recovery among Respondents on HAART at KBTH, Accra, using Logistic Regression.

Variable	Frequency and Percentages (%)	Odds Ratio	P-value	95% Confidence interval
Sex				
Male	73(27.0)	Ref*		
Female	197(73)	1.09	0.83	0.5-2.4
Marital Status				
Single	10(3.7)	Ref		
Married	80(29.6)	1.00	0.77	0.6-2.8
Widowed	112(41.5)	0.62	0.68	0.2-2.0
Divorced/Seperated	68(25)	0.82	0.11	0.3-2.6
Education				
Nil	52(19.26)	Ref		
Primary/JSS	113(41.9)	0.51	0.24	0.2-1.6
SSS/MLSC/Voc/Tech	91(33.7)	0.50	0.24	0.2-1.6
Tertiary	14(5.19)	0.50	0.45	0.1-3.1
Occupation				
Unemployed	37(13.7)	Ref		
Employed	233(86.3)	1.16	0.91	0.4-2.9
Income (monthly)				
Low((<GHc400)	225(83.3)	Ref		
Medium (GHc400-1000)	39(14.4)	1.85	0.33	0.5-6.4
High (>GHc1000)	6(2.2)	0.31	0.16	0.1-1.8
Adherence				
Low	20(7.4)	Ref		
Medium	250(92.6)	0.7	0.68	0.2-3.3
Transport expenses(per each clinic)				
<GHc5	184(68.2)	Ref		
GHc5-10	65(24.1)	2.2	0.10	0.8-6.1
>GHc10	21(7.8)	3.7	0.18	0.5-29.4
Drug Shortage				
No	165(61.1)	Ref		
Yes	105(38.9)	1.5	0.33	0.6-3.11

Ref* means Reference, having an Odds Ratio of 1.

At multivariate levels, females were 1.0 more likely to have CD4+T-cell recovery than males (95% C.I=0.5-2.4, p=0.83).Also, respondents with medium adherence were 0.7 times less likely to have CD4+T-cell recovery than those having low adherence (95% C.I. =0.2-3.3, p=0.68).

Table 8: Health System Factors associated with CD4+T-cell Recovery among Respondents on HAART at the Korle- Bu Teaching Hospital, Accra.

VARIABLES	CD4+T-cell counts<50c/µl N (%)	CD4+T-cell counts>50c /µl N (%)	X^2	P-value
Support				
Agree/Strongly agree	35(13)	234(87)	0.15	0.699*
Neither	0	1(100)		
Respectful				
Agree/Strongly agree	35(13.1)	233(86.9)		
Disagree/Strongly disagree	0	2(100)	0.30	0.58*
Before Respectful				
Agree /Strongly Agree	32(12.60)	222(87.4)		
Disagree/Strongly disagree	2(33.3)	4(66.7)	2.31	0.314*
Neither	1(10.0)	9(90.0)		
Before Respectful				
Agree/Strongly agree	32(12.5)	224(87.5)		
Disagree/Strongly disagree	2(33.3)	4(66.7)	2.26	0.324*
Neither	1(12.5)	7(87.5)		
Believe				
Agree/Strongly agree	15(12.8)	102(87.2)		
Disagree/Strongly disagree	12(24)	38(76)	7.87	0.020**
Neither	8(7.8)	95(92.2)		
Satisfied				
Agree/Strongly agree	31(12.1)	226(87.9)		
Disagree/Strongly disagree	3(25)	9(75)	1.74	0.19*
Happy				
Agree/Strongly agree	35(13.2)	251(86.8)		
Disagree/Strongly disagree	0	4(100)	0.60	0.437*
Service				
Better than expected	11(12.1)	80(87.9)		
About what is expected	24(14.0)	147(86)	1.43	0.490*
Not as good as expected	0	8(100)		
Ask Questions				
Agree/Strongly agree	32(12.7)	220(87.3)		
Disagree/Strongly disagree	3(27.3)	8(72.7)	3.05	0.217*
Neither	0	7(100)		
Clinic Schedule				
Agree/Strongly agree	35	235	-	-
Drugs Available				
Agree/Strongly agree	35(13.2)	230(86.8)	0.94	0.332*
Disagree/Strongly disagree	0	5(100)		
TOTAL		270		

**= Significant at p-value<0.05

*= not significant at p-value<0.05

There was however, significant association between CD4+ T-cell Recovery and belief (Doctors/nurses relationship with HIV/AIDS patients) [Chi-square=7.87, p=0.02].

Table 9: Health System Factors Associated with CD4+T-cell Recovery using logistic regression at the Korle- Bu Teaching Hospital, Accra

Variable	Frequency and percentage (%)	Odds Ratio	P-value	At 95% Confidence interval
Supportive				
Agree/Strongly agree	269(99.6)	Ref		
Disagree/Strongly disagree	1(0.4)	-	0.505	-
Respectful				
Agree/Strongly agree	268(99.3)	Ref		
Disagree/Strongly disagree	290.7)	-	0.58	-
Before Supportive				
Agree/Strongly agree	257(95.2)	Ref		
Disagree/Strongly disagree	5(1.9)	0.44	0.55	0.03-7.21
Neither	8(3.0)			
Before Respectful				
Agree/Strongly agree	255(94.4)	Ref		
Disagree/Strongly disagree	6(2)		0.13	
Neither	9(3.3)	0.76	0.14	0.16-3.27
Believe				
Agree/Strongly agree	119(44.1)	Ref		
Disagree/Strongly disagree	50(18.5)	0.84	0.66	0.39-1.83
Neither	101(37.4)	1.26	0.46	0.68-3.25
Happy				
Agree/Strongly agree	265(98.2)	Ref		-
Disagree/Strongly disagree	4(1.5)	-	0.18	-
Neither	1(0.4)	-	0.50	
Satisfied				
Agree/Strongly agree	256(95.2)	Ref		
Disagree/Strongly disagree	12(4.5)	4.6	0.11	0.58-37.79
Neither	1(0.4)			
Service				
Better than Expected	94(34.8)	Ref		
About what is expected	168(62.2)	1.3	0.43	0.71-2.27
Not as good as expected	8(3.0)	0.8	0.83	0.19-3.84
Ask Question				
Agree/Strongly agree	253(93.7)	Ref		
Disagree/Strongly disagree	10(3.7)	0.3	0.13	0.07-1.49
Neither	7(3.0)	1	0.94	0.20-5.63
Clinic Schedule				
Agree/Strongly Agree	270(100)	-	-	-
Drugs Available				
Agree/Strongly agree	265(98.2)	Ref		
Disagree/Strongly disagree	5(1.9)	1.8	0.59	0.20-16.58
Total				

Ref= reference, having an odds of 1.

Table 9 shows health system factors associated with CD4+T-cell recovery. Belief, though there is an association, it's not significant: (OR=0.84; 95%CI 0.39-1.83, p-value=0.66).

Table 10: Co-infections and the distribution of CD4+T-cell recovery among Respondents on HAART at Korle- Bu Teaching Hospital, Accra

Co-infections	CD4+T-cell counts<50c/µl (%)		CD4+T-cell counts>50c/µl (%)		Total number of co-infections/Percentages (%)
Pulmonary Tuberculosis	4	(25)	12	(75)	16(24.2)
Pneumonia	0		6	(100)	6(9.1)
Candidiasis (Oral, Esophageal, Vaginal)	0		8	(100)	8(12.1)
Diabetes and Hypertension	0		4	(100)	4(6.1)
Gastroenteritis	1	(20)	4	(80)	5(7.6)
Others*	5	(18.5)	22	(81.5)	27(40.9)
Total	10		56		66

Others* =Anaemia, Jaundice, Cerebral Toxoplasmosis, Pharyngitis, Herpes Zoster Pruritic Papular Dermatitis and Hepatitis B

Table 10 shows co-infection and the distribution of CD4+T-cell recovery among the respondents. Pulmonary tuberculosis was high with 24.2% as co-infection with HIV/AIDS and had 75% CD4+T-cell recovery. Diabetes and Hypertension were 4 (6%) with 100% CD4+T-cell recovery.

CHAPTER FIVE

DISCUSSION

5.1 Mean CD4+T-cell counts

The mean increase in the CD4+T-cell counts of 200cells/µl at the end of one year of being initiated on HAART was similar to Gaardbo *et al.,* (2012) study which reported that 20% patients will not achieve immunological response. This is because the immunological non-respondents have severely altered immunological functions, including malfunction and diminished production of cells within the T-lymphocytes. Although Mulu *et al*., (2014) had a high immunological recovery (82%) among adults study in Ethiopia, this study revealed about 87% (n=235) achieved higher immunological response by the baseline CD4+T-cell counts increasing by a minimum of 50cells/µl at one year of HAART initiation. Although the 13% who experienced immunological failure is similar to Collini *et al*., (2009) study in Ghana which followed patients on ART for 3 years. This study is however similar to Kwofie *et al*., (2015) and Annison *et al.*,(2013) at Komfo Anokye Teaching Hospital and Kumasi South Hospital which reported that the administration of ART resulted in immunological recovery by increase in CD4+T-cell counts with adherence to HAART.

5.2 Socio- demographic/Patient factors

In this study, 10 patients who were found to be less than 30 years were found to have a higher CD4+T-cell recovery of 100%, whilst 70 patients of 30 - 39 years had CD4+T-cell recovery of 87.5%, patients of >50 years were found to have a recovery 85.3% (Table 5). Findings from this study are similar to Carter (2011) which reported that patients of older age (>50years) had fewer naïve CD4 cells compared to younger age in Paris. This is as a

result of a patient's body's immunological activities which takes place when one is initiated on HAART.

Although the females had a slightly higher CD4+T-cell (87.3%) recovery than the males (86.3%), it has been reported by Sempa *et al*., (2013) in a 7 year study in Uganda that immune recovery is slower in men than women because the women were found to have CD4>400cells/µl increase earlier than in the men. This may probably be a reflection of women's better health seeking behavior than men, women are more likely to adhere to treatment and eat nutritiously (Annison *et al.*, 2013, Folasire *et al*., 2012).

In this study, those without any level of education had a CD4+T-cell recovery of 92.3%, while those with tertiary had 85.7%. This is contrary to Luguterah and Adams, (2013) study previously carried out in Northern Ghana which reported that those with higher level of education had a high CD4+T-cell recovery.

Furthermore, patient adherence to taking the ART in CD+T-cell recovery is very important, this study found the respondents had medium adherence of 7 for 250(92.6%) patients, however 217 of the patients had a recovery of 86.8% of cell increase although the differences was found to be non-significant (p-value 0.68 at 95% CI: 0.2-3.3) (Table 6 &7). In Ethiopia an adherence of 87% have been reported by Mitiku *et al.*, (2013), this is similar to this study (86.8%). HAART gives effective check against the activities of the virus and reduces the viral loads in infected individuals (Rougemont *et al*., 2009). It is obvious that the patients took their HAART, which is the basis for fighting the virus. .Scanlon and Vreeman (2013) pointed out in a review that improving assess to adherence must have interventions that addresses its barriers.

Having co-infection and being initiated on the HAART is reported to protect the patients against the risk of death (Yang *et al.*, 2014). Some of the respondents as at the time of being initiated on the HAART, had co-infection of various diseases. Some of the co-infections were: Pulmonary Tuberculosis, Pneumonia, Gastroenteritis, Candidiasis (Esophageal, Oral and Vaginal), Hypertension, Hepatitis B, Cerebral Toxoplasmosis, Herpes Zoster, Diabetes Mellitus, Respiratory Tract Infection and Pruritic Papular Dermatitis, among others. Out of the 270 respondents, only 66 (25%) had co-infections. Those with pulmonary tuberculosis co-infection was 24.2%, this is similar to WHO finding that the risk of developing Tuberculosis is between 26 and 31 times greater in those infected with HIV (WHO, 2015). HIV/AIDS pandemic has caused an emergence of Tuberculosis and increased morbidity and mortality worldwide (Sharma et al., 2005). Coinfections are common in HIV patients because HIV predisposes the infected individuals to these infections (MNT 2015). In a South African study, Herpes Zoster was reported be 2.3% in HIV patients (Shearer *et al*., 2014). In Ghana the double burden of HIV, tuberculosis, malaria (communicable diseases) and non-communicable diseases like stroke, hypertension and diabetes has been documented (Aikins, 2007). Cryptococcal meningitis, tuberculosis and cerebral meningitis also constitute infections of the Central Nervous System and Primary CNS Lymphoma have been reported in HIV patients (Leligdowicz *et al*., 2006). A study by Sagoe *et al*., (2011) in Ghana found out that 13% of the HIV patients had Hepatitis B coinfection. This study therefore shows that coinfection among HIV patients increases morbidity and mortality (Sharma *et al*., 2005), so continuous planning and interventions to treat these infections have to be considered.

5.3 Hospital/System factors

The hospital/system factors explored the availability of HAART, waiting time at the clinic, availability of laboratory equipment and reagents, doctors and nurses relationship to patients, cost of care and confidentiality (Table 4). This study revealed that the availability of HAART was found to be 98.2%. When there are drugs available, patients easily go to the hospital for refills, adherence is improved, drug resistance is reduced, and patients look healthier and are able to go about their normal businesses (Howley *et al.,* 2010; Collen *et al*., (1999). The introduction of HAART in the first place was to reduce the viral load in the infected individuals and enhance immunological recovery by increasing the CD4+T-cells (Mulu *et al.,* 2014). As a result, the demand for HAART will continue to grow in the coming years (Schouten *et al*., 2011).

In this study, the respondents were very satisfied with the waiting time at the clinic because they did not waste too much time when they came to the clinic. This is similar to a study in Ghana where generally, the patients (who were insured on National Health Insurance Scheme) were very satisfied with the waiting time at the clinic (Fenny *et al*., 2014). This findings is contrary to a study in Kenya where the patients were dissatisfied with longer waiting time at the clinic (Wambua *et al.,* 2015). It was observed that the picking of patients' clinical records, checking of weights and blood pressure, queuing to the consulting room, picking up HAART and getting an appointment schedule were efficiently organized to give patients the needed satisfaction. This was similar to a study in Tanzania by Miller *et al*., (2014) which found out that patients were very satisfied as the doctors and nurses took care of less than 10 patients a day.

Furthermore, the doctors and nurses at the clinic were found to be respectful and supportive to those with HIV/AIDS. This is very important as it boosts the patient's confidence to continue attending the clinic, thus get all the medical attention and this enhances life quality generally and is likely to recommend that clinic to others, (Woodward, 2000), However dissatisfaction with clinical services stop patients from going to the hospital to assess care and medications (Daban et al., 2008). This study is similar to Iloh *et al.*, (2013) a study in Nigeria which reported satisfaction from the medical staff as good. Similarly, Nwabueze *et al*., (2011) also had an overall high patient satisfaction score for healthcare workers in a study carried out in an ART clinic of a Nigerian tertiary hospital. Another study in Sunyani Regional Hospital of Ghana also reported that patients were very satisfied with the service delivery at the hospital (Peprah, 2014), whilst a study conducted in China have revealed that health professionals had negative biases against patients with HIV/AIDS (Li *et al*., 2007).

Cost of care involving transportation expenses, laboratory expenses and drug expenses were found to vary in this study. Over 95% had money to come to the clinic at their appointment schedule. This is very important because if one cannot commute to the hospital, he/she cannot get the refills of the HAART and will not be adherence complaint. Moon *et al.,* 2008 argued that some of these expenses can constitute financial barriers to some of the patients, which will stop them from assessing medication and care. Findings in this study is slightly higher than a study in South Africa which reported that 90% of the patients paid for transport to attend clinic (Rosen *et al.,* 2007). HIV/AIDS households spent more money on medical care and transportation cost than households without HIV/AIDS (Falleiro, 2014). This means that transportation expenses are very important when dealing with HIV/AIDS care since some patients will prefer to go to health facilities

that are further away from their communities to avoid stigmatization because some of the patients are still being stigmatized and discriminated against by healthcare workers (Famoroti *et al*., 2013).

Confidentiality is a fundamental principle which is grounded in patient's right to autonomy, and the main source of concern is disclosure of the HIV status to others (Williams M., 2011). Stigma is a very big issue with HIV and many studies have reported that stigma may discourage patients from accessing care and taking their medications (Chambers *et al.*, 2015; Rao *et al*, 2012; Dlamini *et al.*, 2009 Sabin *et al*., 2008, Kinsler *et al*., 2007). When patients are stigmatized by their healthcare providers, they will not feel free to ask questions bothering their health and this will not enable them to relate well and feel relaxed with them. This study showed otherwise, patients were very satisfied with the level of service and were free to ask questions about their health**.** Famoroti *et al*., (2013) study in Kwazulu-Natal, South Africa reported there was continuous gossiping among health care workers about patients' HIV status which compromised patients' confidentiality. With confidentiality, patients are able to trust their healthcare providers like doctors, nurses and allied health professionals, this will make them happy, have positive attitude towards life, enhance patients' continuity to clinic and hence enhance CD4+T-cell recovery.

5.4 Hospital factors associated with CD4+T-cell Recovery is Respect

The belief that patients will be treated respectfully when they come to the hospital with HIV/AIDS infection (doctors/nurses relationship to patients) was found to be significant with p-value of 0.020 ($p<0.05$) (Table 8). Healthcare system is very important and when patients are satisfied, they will keep coming to the clinic which is linked to care and

retention in care (Peprah, 2014, Woodward, 2000). A study carried out in South Africa showed that while patients observed that although some patients were not being respected by some healthcare workers, they themselves were respected by their healthcare workers (Chimbindi *et al.,* 2014). If patients are respected at their various clinics, they will spread the good news about positive hospital factors to other infected people in the community and this will help them to make decisions concerning visiting the hospital for early treatment. The people in the community will like to visit the hospital when they have HIV/AIDS because of the results of some of the patients who have already gone to receive care there. The government of Ghana through its technical bodies like the NACP and GAC are working hard to reduce HIV/AIDS prevalence and also to reduce morbidity and mortalities due to the virus (Fobil and Soyiri 2006). It's quite expected that when people in the communities have HIV/AIDS that they go to the hospital for prompt care and timely intervention and also initiation into ART as soon as possible. When patients don't believe they will be treated with respect at the hospital, they will not go, which will jeopardize the Governments' activities and efforts (Fobil and Soyiri 2006). It's therefore imperative that the hospital system and health care workers should respect and treat all patients with dignity and respect.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

This study has shown that the introduction of HAART actually causes immunological recovery by the mean increase in CD4+T-cell counts.

The socio-demographic/patient factors that enhance CD4+T-cell recovery are listed as age, sex, educational level and adherence. The healthcare workers are trying to take care of the patients while at the same time reducing disease progression to AIDS and death.

The belief that patients will be treated with respect when they come to the hospital with HIV/AIDS infection was found to be associated with CD4+T-cell recovery. The hospital/ system factors enhance CD4+T-cell recovery in this study.

6.1 Recommendations

Based on this study, a number of recommendations can be made:

- The doctors, nurses and allied health professionals at the Fevers' Unit should continue to maintain better health service delivery to those with HIV/AIDS in terms of respect, support and confidentiality.

- NACP and all her developing partners should continue to ensure that there are HAART available for all the people living with the HIV.

- Non-Governmental Organizations can continue to carryout programs that will help the PLHIV, so that they can engage in meaningful socio-economic activities which will enable them to financially make it to the hospitals at their respective appointment times.

- Further research is needed to find the cause of widowhood among 17% of the respondents.

- As more people with HIV/AIDS are approaching ≥50 years, it's a source of worry due to the fact that they do not achieve immunological recovery earlier enough, this can be subject for further investigation.

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APPENDICES

Appendix 1: Consent Form

RESPONDENTS INFORMED CONSENT FORM

My name is **ADJOA OBO-AKWA**, a female student of the School of Public Health, University of Ghana. I am conducting a research titled: **FACTORS ENHANCING CD4+T-CELL RECOVERY AMONG HIV POSITIVE PATIENTS ON HIGHLY ACTIVE ANTIRETROVIRAL THERAPY FOR ONE YEAR AT THE KORLE-BU TEACHING HOSPITAL, ACCRA**. Your response will be used to find out how CD4+T-cells recover.

I will be pleased if you could give me the permission to ask a few questions in relation to the study. I want to assure you that any information you provide will strictly be confidential, for the purpose of academics.

This study is being carried out to find the effect of Highly Active Antiretroviral Therapy on CD4 counts; you will just answer questions using a questionnaire.

You may also voluntarily opt out of the study anytime if you so wish, this will not affect the care you receive at this hospital in any way.

The results of the research will add to scientific knowledge in HIV/AIDS research.

If you have further questions, you may contact the **Ethical Review Committee (ERC) Administrator of the Ghana Health Services, Madam Hannah Frimpong on 0243235225 or 0507041223**.

Thank you.

'I have read the information or it has been read to me and has had opportunity to ask questions. I consent and voluntarily agree to participate and understand that I can withdraw at any time without it affecting my medical care'.

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Participant's signature or thumbprint Date

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Signature or thumbprint of witness Date

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Name & Signature of Person Obtaining Consent Date

Appendix 2: Questionnaire

QUESTIONNAIRE FOR THE RESEARCH TOPIC:

Factors Enhancing CD4+T-cell Recovery among HIV Positive Patients on Highly Active Antiretroviral Therapy for One Year at the Korle-Bu Teaching Hospital, Accra.

Kindly answer these questions concerning how you feel about the hospital. It will take few minutes.

Section A: Demographics

1. Patient Code_____ **KF No_____-**

2. Sex: Male (1) Female (2)

3. **Age** (as at last birthday) _____

4. **Marital Status** Single (1) Married (2) Widowed (3) Divorced (4) Separated /Cohabiting (5)

5. **Educational Level**

Nil (1) Primary/JHS (2) SSS/MSLC/Sec/Tech/Voc (3) Tertiary (4)

6. Occupation

Civil/ Public Servant (1) Professional (2) Businessman/woman (3) Artisan (4) Hairdresser/Seamstress (5) Trader (6) Hawker (7) Unemployed (8) Others specify (9) _____

7. Income level Less than GHC 200 (1) 200-399GHc (2) 400-599GHc (3) 600-799GHc (4) 800-1000 (5) Greater than 1000GHc (6)

8. Place of Residence: Rural (1) Peri-Urban (2) Urban (3)

9. **Do you have an NHIS card?** Yes/ No.

10. If yes do you use the card when you come to the clinic? (1) Yes (2) No (3) Sometimes

SECTION TWO

11. **Date of HIV Diagnosis** (extracted from the folder) _____

Risk factors

12. How will you describe yourself? Heterosexual (1) MSM **(2)**

Mode of transmission Heterosexual (1) MSM **(2) Blood** transfusion **(3)** Mother to Child (4) Any Other (Specify) **(5)** _____

13. **WHO Clinical Stage** (at the time of diagnosis, extracted from the folder) **1**.I **2**. II **3.** III **4.** IV

14. Date start HAART (extracted from the folder) _____

15. HAART Combination COMB/EFV **(1)** COMB/NVP (**2**) TDF/EFV/3TC **(3)** TDF/NVP/3TC **(4)** Others specify (**5**) _____

16. **CD4 Count at entry/baseline HAART (**extracted from folder) _____c/ul date of lab _____

17. **CD4 Count at I year of HAART** (extracted from older) _____c/ul date of lab _____

18. **Any disease condition at initiation of HAART** (extracted from the folder)

Yes/No If yes, specify _____

19. ADHERENCE TO HAART-

QUESTIONS	Yes	No
Do you sometimes forget to take your medicines?	1	0
In the past two weeks have u forgotten to take your medicines?	1	0
Have you ever stopped taking your medicines without telling your doctor because you felt worse when you took it?	1	0
When you travel or leave your house do you sometimes forget to go along with your medicine?	1	0
Did you take all your medicine yesterday?	1	0
When you feel like you are not sick, do you sometimes stop taking your medicine?	1	0
Do you ever feel bothered about sticking to your treatment plan?	1	0
Do you have difficulty in remembering to take your medicine? Never/Rarely.....0 Once in a while.....1 Sometimes.....2 Usually.....3 All the time.....4	1	0
TOTAL SCORE		

Hospital/System factors.

Please select the most suitable response **1=strongly agree 2=Agree 3=Not sure 4=Disagree 5=strongly disagree**

20. The health care providers are supportive of people who have HIV/AIDS

1 2 3 4 5

21. If not, in your opinion, why not?

_____

22. The healthcare workers are respectful to people who have HIV/AIDS. **1 2 3**

23. If not, in your opinion, why not?

_____

24. Before coming for treatment, you expected the providers would be supportive of people who have HIV/AIDS

1 2 3 4 5

25. Before coming for treatment, did you expect that the providers would be respectful to people who have HIV/AIDS?

1 2 3 4 5

26. Most people believe they will be treated respectfully by health care providers if they have HI**V/AIDS.**

1 2 3 4 5

27. You are satisfied with the waiting time at the clinic.

1 2 3 4 5

28. You are happy with the service you are receiving from this facility.

1 2 3 4 5

29. The level of service you are getting from this facility is_____ **1**. Better than you expected **2**. About what you expected **3**. Not as good as you expected

30. You have been given the opportunity to ask questions about HIV/AIDS.

1 2 3 4 5

31. You are satisfied with the clinic schedule (clinic days). **1 2 3 4 5**

32. Drugs (HAART) are available at the health center.

1 2 3 4 5

33. Has the hospital experienced any shortages of HAART (drugs) in the past year?

1. Yes **2**. No **3.** Don't know if No, skip to Q37

34. If yes for how long?

1. One month 2. Between 1-3 months
3. Between 3-6 months 4. More than 6 months

35. Did it result in patient interruption of treatment?

1. Yes **2**. No **3.** Don't know

36. What were the reasons for the shortage? **1**. Procurement not made in time **2**. Late delivery

3. No requisition forms to order for the drugs **4**.Dont know

5. Others (Specify)

_____

37. Have there been shortage of laboratory reagents like CD4 counts in the last one year?

1. Yes **2**. No **3**. Don't know if No, skip to **Q39**

38. What were the reasons for the shortage of the reagents? **1**. Procurement not made in time **2**. Late delivery **3**. No requisition forms to order for the reagents. **4**. Don't know

5. Others (Specify)

_____

39. How far is your home from this health facility? (Distance or time)

1. Less than 30 minutes **2**. Less than 1 hour **3**. Between 1-2 hours **4**. More than 2 hours

40. How do you commute to the hospital? **1**. Private car **2.**Taxi **3.**Bus (trotro)
4.Walking **5.** Others (specify) _____

41. How much do you spend to get to the hospital in answer to question 40?

_____

42. Is there other health facility closer to your home? **1.** Yes
2. No

43. Do you have to pay to see a health provider? **1.** Yes
2. No →SKIP TO Q 45

44. How much _____

45. Do you have to pay to have the lab test done? **1**. Yes
2. No → SKIP TO Q 47

46. How Much? _____

47. Do you have to pay for the drugs and other treatment? **1**. Yes **2**. No→ SKIP TO Q 49

48. How Much? _____

49. Do you have the money to buy the drugs and do the labs? **1**. Always **2.** Sometimes **3.** Never

50. Cost of consultation/care is satisfactory **1** (strongly agree) **2** (agree) **3** (disagree) **4(Strongly** disagree**)**