T.R.N.C

NEAR EAST UNIVERSITY

INSTITUTE OF HEALTH SCIENCES

Application of Multivariate Statistical Methods of Patient Surviving ART Follow-up

(A case Study of Federal Teaching Hospital Gombe State Nigeria)

A THESIS SUBMITTED TO THE GRADUATE INSTITUTE OF HEALTH SCIENCES NEAR EAST UNIVERSITY CYPRUS

BY

KABIRU BALA

In partial fulfillment of the requirement of master of science in Biostatistics

Advisor:

Assoc. Prof. Dr. İlker Etikan

NICOSIA 2018

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DEDICATION

I firstly declare this research study work to My Beloved Sister and Dear wife Rashida Kasimu who stood for me hundred percent to ensure that my programme was successful. My Parent. My Sponsors to Near East University Cyprus for my Master in Biostatistics Taraba State Polytechnic Suntai and Tertiary Educational fund (Tetfud) my gratitude to you all.

APPROVAL PAGE

This Dissertation is going be tendered to the Institute of Health Sciences Near East University in partial fulfillment for the essential of degree of Master of Science in Biostatistics.

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ABSTRACT

The study design focuses on group investigation conducted in Gombe State Teaching Hospital Gombe Nigeria. However, the discovery of who had get registered for the Antiretroviral Therapy (ART) at the hospital within similar period has been taking account by monitoring their follow-up. Device of data collection was sample from population of HIV positive victims on antiretroviral therapy registered for treatment from record of the hospital data base unit, Data variable used were age, gender, CD4, Haemathology, Chemistry, Hospital status, marital status, state month of last visit, state month for last visit, occupation, tribe, age category, last quarter of last visit, last quarter of next visit. place of residence, to said but little. Performing of ART treatment based on types one, type two and type three. The follow up investigation considered those losing follow up, relocation (migration) to another place, culture of Incomplete turnout. The result as was ascertained on the enormous female turnout, is a signal that reveal how women were devoted with regards to submission to treatment for the HIV/AIDS during follow-up. As it was observed some tribe and places especially those coming from rural areas were still having negative mindset concerning about the virus. Base on the collected fact there was problem of update for patient check-up from the laboratory and update of patient record form the data base. More so the analysis result showed that tender age was having the highest contamination with the virus. Married teams were seen to be more shocking with highest number of patient with the virus from all age groups. Based on the achievement seen that the course of death due to HIV was reduced compared to the previous years, this shows that the introduction of the ART play a part very well in achieving this progress. All the teams concerned played a vital role as a matter of fact. A way forward, the effort of HIV/AIDS should tackled be young reduction, it should be effected towards preventing feature coming up generation with contamination of the virus in the hospital and Nigeria in general. Also those concerned should maintained the provision of resources and allocation for boosting the care of treatment strategies of people leaving with the virus however, State Government should joint hand with those supporter to assist. Lastly with regards to the success achieved those in the section, deserved to be sincerely empowered and motivated.

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CHAPTER ONE

1.0 Introduction

Human Immunodeficiency Virus (HIV) fit in to a company of viruses called retroviruses. Is a specific virus that was well-known for the past decade. The current antiretroviral medicines that is available for now is only to reduces the infection rate but cannot be able to cure people with the epidemic. However with regards to prices of drugs it became a major problem especially for developing countries (UNAIDS, 2004). The discovery of HIV in 1980 became a global disease that course harm to the immune system of the body that taken the lives of about 20 million people while 38 million people based on estimated were living with HIV around the world (MOH, 2005). People leaving with HIV/AIDS in the society have been facing challenges, since the beginning of the existence of the epidemic. Despite of this circumstances relating to expectation of HIV stigmatization, previous studies gave very little or no care. The virus HIV rapidly strikes the immune system by causing a serious harm to the body. Individual with HIV virus is prompt to danger of evolving critical infections which a healthy immune system will result to problem devoid of curing and taking care of the virus. (UNAIDS, 2010) confirm that about 68% (22.5 million) of Sub-Sahara have contact with the disease. Also get along with the United Nation grouping of epidemic generalization almost 90% of people leaving in the region of Sub-Sahara are having connection with the disease. This makes the region to be become with the highest death due to the major course of the epidemic. Though the region only recorded 10% of the world population, it consist of about 25.8 million of HIV victims across the globe. It was estimated that in 2005 about 3.2 million newly people in the region became infected, whereas 2.4 million died of the AIDS. The percentage of HIV infected women and men recorded were 4.6% and 1.7%, respectively. 2010 recorded 2.7 million of newly infected people with the virus which HIV/AIDS report to have about approximately 90% of all infection. By then Ethiopia in region of Sub-Saharan Africa was at the lead, taking the highest number of people living with HIV epidemic, this makes them to be highest worldwide with number of reported cases at the regional levels. The cure for HIV virus in the body assist in reducing the active of the virus so that the immune body system will be at normal stage. Means the cure would not completely wipe out the virus but with sticking to the right treatment and care, person with HIV could believe to live a long and healthy life**.** The HIV virus

normally exist in semen, vaginal fluids and moisture in the rectum, blood, genital fluids and breast milk. The new infected cells into the pool that the reservoir will be saved with antiretroviral therapy possibly totally stops the new entrance. Central memory cells are place where most of the integrated HIV genes are found. Another means of becoming a victim is through the course of insecure anal, vaginal and oral sex, by sharing of injecting or razor blade and mother transferring to her baby during pregnancy or in the course of breastfeeding. The only way of preventing is by conducting a blood test, it can reveal if a person is HIV positive, when it is positive then one can get active antiretroviral therapy (HAART) to start the curing transformation of HIV. Indications symptoms of HIV involves fever, rashes, losing of weight, unscrupulous contagions, such as Pneumocystis carinii pneumonia, neoplasms, Kaposi's sarcoma, and central nervous system dis function , it could be mutual complications. The virus HIV normally infects the immune system cell then the genetic substance develops combined into the human DNA in to the cell. The cells begin pumping out new viruses. Immediately the cell started to respond to an infection which influence other activated cells in the area, and the same cycle starts all throughout again. The virus is invisible to the body immune system however impossible to eradicate unless by using antiretroviral drugs which by so doing gradually it will reduce the infected number of cells. Many countries all over the world experiences an increase rate of the epidemic because of the random distribution, which became the major problem of almost every country around the globe that tend to destroy people lives. With the amount of money spending, concerned and commitment about the diseases, It continuously increasing all over the world. The HIV cases remains extremely active with fast growing and developing some changes of creature as the virus develops system for broadcasting. More so people living with the virus keep on continuously progressing yearly. Since then the health researchers realizes the virus as problem to human being started undergoing different research to see how the epidemic will be control using different drugs or vaccine. Because of how the unique nature of the disease it was not easy to succeed in advancing vaccine or medication that will completely cures the disease. The epidemic has become a global issue because almost all the countries have undergone through the incidents. There was no region around the world that has been saved. There were various courses of HIV transmission, which differs significantly from different areas around the world, though the circulating of the epidemic around the world varies from region to region that is some part were more affected compare to another part. However several channels of how the disease is transmitting from one person to another was

revealed out. Homosexual sex and via intravenous drug injection in developed countries were considered to be the usual source of transmission of the virus while heterosexual contact in developing countries is the major courses of transmission. Because of Sub-Saharan Africa dominated the part of the world by toping and broken to be the highest with the history of the epidemic. Then there is need for info on the degree to which individuals should expect mark out responses from people in their society as well as factors that will lead to the expectancy of HIV disgrace. This facts will help the HIV counselling service in delivering, which will go alone way in designing interventions that will lessen the expectancy level of HIV associated disgrace especially between individual that have not yet tested for HIV to know their status. While investigation based on the aspect of understanding the circumstances relating to HIV epidemic that has to do with humiliation clearly contribute drastically to the improvement of speculative cares used for studying relationship between HIV/AIDS connected shame and testing for HIV.

1.1 Contests of HIV epidemic

One of the challenges of HIV is the lymphoid tissues that hide the infected cell by assembling of foreign storage area which as a result be difficult for the inspection of the immune system. This lymph bumps that is filled with CD4 cells will be spread slowly all over the body by becoming jammed with HIV epidemic after the disease. Again, another method that foreign complication goes in to the body system is through the lymphoid tissue around the fences of the gut because it has the abundant attention of cells infected with HIV epidemic lying in plentiful. Also the virus destroys the cells in the bone marrow which at the end set apart into several immune system cells. At each point in time when the cell is been broken or divided, it create another copy of instruction for generating a new virus, this is what occurred when HIV infects the memory of the CD4 as a result will retain previous information of infection that are encounter so that there will be a quick respond again when there is any encountered. More so frequently the cells replicate as a result of falling count of the CD4. In fact this clarify the reason why the infected cells of HIV reservoir is much with people leaving with chronic HIV infection. The first weeks of HIV infection is the time when the reservoir will be established, previous copy is examined by to some extent successful with response of the immune system. More so the reservoir magnitude will be powerfully affected by the period of unchecked viral repetition then the gravity of CD4 would drop. The reservoir of patient with HIV undergoing wholly suppressive HAART for many years

would be different with CD4 that is sick in every billion of individual that are treated immediately after infection, That is each sick cell in every 10,000 CD4 in patient that start treatment when infection was in chronically stage. This is according to Anthony Fauci's research trial unit. Nevertheless mostly people that commence HAART within less than six months after been infected the infectious virus will no longer be advance from their cells after a year of medication but it will still be detected in person that begin treatment later, regardless of some years of HAART. Expert say the best means of dealing away with infected people is commencing a treatment within the weeks the person got infected at that point in term the reservoir will not have any chance to be satisfactory lunched itself. Professor Routy advocate that patient in this company CCR5 inhibitors will be used to reduce the amount of virus that enters the cells , the integrase inhibitors will help in preventing the connecting genes in the DNA of cells that enter, then cytokine interleukin-7 will stimulate the infected cells thereby organizing the lymphocytes to kill the cells that generate HIV. Another encounter is when the size of the reservoir cells is infected which usually occur with people that have chronic infection, by reducing this reservoir the replication of the virus is also going to be reduce which will increase the immune reactions. The fundamental aim of therapeutic vaccine is to safeguard the load of the viral by making it to be invisible then the cytotoxic T-cells, or CD8 cells, should be identify and destroy any cells that are infected which can be in position of ejecting another virus. Therapeutic vaccination help in reinforcing the immune responses because the vaccination boosts the particular body immune response to HIV through the means of hyper-sensitize portion of the immune system to the viral mechanisms, with the plan to generate a resistant situation which will go alone in keeping low viral burden without necessary drugs, which at the end, extend the time that will be consumed off HAART. With this regards the method produces much in the controlling of HIV immune system, with the rejection of preliminary outcomes from a latest Canadian research which advocated that a vaccine personalized for each individual in the study performed to sustain HIV below pre-treatment levels during 12 week treatment disruption.

1.2 Year in year out challenges of HIV arround the globe

History of HIV started around 1920 in Kinshasa, Democratic Republic of Congo at then the virus was crossed species from chimpanzee to human. Realizing about the transmission of the disease was not known however many people were affected, the sign and symptoms was not

recognize until 1980s. But unusual incidents of the virus were recorded in previous 1970, based on the record obtained from the epidemic begun in 1970s. However in 1980, It was already spread in five different continents with about 100,000 to 300,000 people have been affected. This continent were Africa, North America, South America, Europe and Australia. Towards the end of the year 1981 there were 270 incidents reported of severe immune deficiency among people while 121 were reported death. In Southern California by June 1982 people said to believe that the cause of HIV was sexual while syndrome was originally refers to gay interrelated immune deficiency. It was later reported in the haemophiliacs and Haitians which many people consider that it has it basis in Haiti. By September for the first time CDC was term used as Acquired Immune Deficiency Syndrome (AIDS) also is been defined as disease that is predicted of failing in cell intervening immunity, appearing to an individual with no experienced case for lessened resistance to the disease. HIV/AID epidemic cases was reported in Europe while in Uganda, doctors authenticate new cases of serious destroying disease known as slim. This brings the coming together of organizations dealing with HIV such as the Terrence Higgins Trust in the United Kingdom with San Francisco AIDS Foundation (SFAF) in the United State of America. Similarly in May 1983 Doctors reveals from Pasteur Institute in France there was a new discovery of retrovirus that called Lymphadenopathy-Associated Virus (LAV) that causes of HIV, the epidemic was discovered among the female partners that involves in heterosexual sex while in June children was reported with the same case through direct contact from their mothers before, during or shortly after birth. World Health Organization (WHO) conducted the first meeting for assessing the global AIDS situation and started international investigation. At the end of the year the number of AIDS cases in the United States of America had escalated to 3,064 and 1,292 lost their lives. In spite of this in the month of April 1984 the National Cancer Institute declared that they had discovered the basis of AIDS epidemic, a retrovirus HTLV-III. Pasteur Institute in their joint conference announced that LAV and HTLV-III were identical and the likely cure HIV/AIDS. A blood test was created for screening the blood, the test was created for the virus with the expectation that the injection will be established in two years to come. Any means of getting infected with the virus via sharing of needles during injection. Also, private sex clubs in San Francisco were locked down due to high risk of sexual action then New York and Los Angeles supported within the year. This brought about 7,699 cases of HIV and 3,665 of cases that died in USA at the end of 1984. And 762 cases in Europe was reported. Another development from the U.S Food and Drug Administration (FDA)

in 1985 that registered a first commercial blood test, ELISA, for detecting antibodies to the infection which the Blood banks started screening of USA blood supply. The first International AIDS Conference was organized in Atlanta Georgia by U.S. Department of Health and Human Services (HHS) and the World Health Organization (WHO). A teenager Ryan White from Indiana, USA who gotten HIV by means of contaminated blood products used for the treatment of his haemophilia and he was expelled from school. More so in October Rock Hudson an actor dies as a result of HIV epidemic been the first prominent profile decease. The decease left about $250,000 in other to set up the American Foundation for HIV/AIDS Research (amfAR). Prevention of a mother to child transmission of the HIV was first recommended by U.S. Public Health Service in December, at the end of 1985, cases of HIV/AID in every region of the world was reported to be 20,303. Though by the end of the year 1986 there were reported cases of 85 countries with 38,401 cases of AIDS that have reported by World Health Organization. Africa had 2,323, Americas had 31,741, Asia had 84, Europe had 3,858, and Oceania had 395. More so at 1986 there was International Committee on the Taxonomy of Viruses which AIDS formally called HIV (human immunodeficiency virus) instead of HTLV-III/LAV. World Health Organization (WHO) Introduces a Global Program on AIDS by creating familiarity in February 1987. Based on NGOs policies, technical and financial support to countries they introduced a policy for promoting people rights living with HIV. However In March, the FDA endorsed the first antiretroviral drug, zidovudine (AZT), for treatment of HIV/AIDS, In April FDA certified a specific HIV antibody test that term as western blot blood test equipment, WHO confirmed in July that HIV could be circulated as a result of breastfeeding from a mother to child. United Nations (UN) General Assembly in October debated the first illness on HIV/AIDS. By December WHO estimated that about 5 to 10 million people were living with HIV in the world with 47,022 from USA. The first World AIDS Day was known by WHO in December 1988 . It has become a nationwide HIV/AIDS care system in the USA which subsequently funded by Ryan White CARE. More so an approximation of 142,000 AIDS cases was reported in March 1989 from 145 counties. Then again, WHO confirm based on estimate to have 400,000 cases across the globe while the first guideline for preventing PCP was released by CDC in June, it became infection that usually cause death among people with HIV epidemic, it was reported that United States of America had 100, 000 instances by then. Ryan White on 8 April 1990 died at the age of 18. His death was course by HIV/AID. There was campaign on 6th July against the USA immigration policy for stopping people

with HIV from entering the country. International AIDS Conference in San Francisco initiated that. NGOs shunned the conference while in July there was bans against those with disabilities and people living with virus. Confirmation of using zidovudine (AZT) by FDA was done in October for medication of babies with HIV/AIDS. Over 307,000 people living with HIV at the end of the year 1990 reported to have contacted with the virus. People living with virus were 8 to 10 million worldwide existing with the epidemic. Red Ribbon Project was inaugurated in 1991 by a Visual AIDS Artists Assembly for generating the sign of consideration for people living with HIV epidemic. This made red ribbon to be fitted in the International symbol of HIV/AIDS realization. However, a professional player of basketball called Earvin Johnson the Magic revealed that he was infected by HIV positive which make him to announce his retirement from the sport carrier, His planned for the leaving was to go about educating teenagers concerning the epidemic. The system assisted in reducing the spread of the disease in the US and other regions. After magic declaration some weeks later, lead singer of rock group Queen Freddie Mercury also disclosed his status of HIV then the following day he was death. Also In 1992 the International AIDS Conference held in Amsterdam. Tennis best Arthur Ashe discovered to be infected with HIV as outcome of a blood transfusion in 1983. Examining kit used by healthcare professionals for detecting HIV-1 in 10 minutes was licensed by FDA in May. Then again Voting of United State of America Congress was held in March 1993 overpoweringly the concealing ruling out on entry into the country for people living with HIV epidemic. CDC additionally increased tuberculosis, cancer and any deathly disease to the list of AIDS statistics. Around 700,000 were suffering with the virus infection in Pacific and Asia, closed to end of the year 1993 an estimated of 2.5 million HIV cases was reported all over the world. Subsequently the USA Public Health Service in August 1994 certify the use of AZT for any HIV transmission from mother to child. Then in December the FDA approved an oral HIV test for the first non-blood of HIV test. Also, confirmation approval of the first protease inhibitor kick off a new time of highly active antiretroviral treatment (HAART) by FDA in June 1995. As a result of the clinical system of HAART there was quick reduction of death estimate of 60 to 80 percent while hospitalization in affected region can afford. Towards the year ending, an estimated of 4.7 million new cases of HIV epidemic was recorded in Southeast Asia with 2.5 million and Sub-Sahara with 1.9 million, then Organizing for the promotion of global action on the widespread and coordination for HIV within UN was organize in 1996 using the Joint United Nations Programme on AIDS (UNAIDS). However 11th International AIDS Conference in

Vancouver stressed the success of HAART in terms of reducing the virus. Again the first home testing kit was granted by FDA for checking viral load test for assessing the balanced of HIV in the body system with the first non-nucleoside transcriptase inhibitor (NNRTI) medicine (nevirapine) and also the first HIV urine test. Near the year ending 1996 new detection of HIV outbreaks was discovered based on estimate 23 million of people living with HIV. This region include Eastern Europe former Soviet Union, India, Vietnam, Cambodia and China among others. The United Nation for International Development (UNAID) and World Health Organization (WHO) said based on their estimate from the introduction of ARC antiretroviral in 1996 many people who have access to availability of actual treatment healthcare was change meaningfully, by estimates about 2.9 million of victim's life was saved. FDA in September 1997 also commended for Combivir, which is the combination of two antiretroviral drugs that can be swallowed as a single daily dosage, this becomes easier for patient with the epidemic to take for the treatment. At then there was 16,000 daily report of new contact cases that result to 30 million victim had HIV in the world based on UNAIDS calculation, World health organization (WHO) in 1999 stated that AIDS became one of the 4th leading cause of death around the world while Africa is the number one with the massive death. From the WHO estimated 33 million people have contacted with the virus while 14 million people lost their life as a result of the deathly disease. Base on the compromised of reducing the price of antiretroviral drug for developing countries with five pharmaceutical companies was setup by UNAIDS in July 2000 while in September, UN embraced the MDG to add in a specialized ambition that will reversed the distribution of HIV epidemic, malaria parasite and also TB. The General Assembly of United State at June 2001 appealed for the establishment of a global fund that will support the efforts of countries and Organizations to battle the spreading of the epidemic and also to prevent, treatment with care as well as obtaining drug. However, Cipla in India started reduction of prices of standard drugs after production especially for developing countries by so doing a number of pharmaceutical companies accepted to reduce their prices of drugs also. In November developing countries ensued approval to manufacture standard drugs for contesting nation wellbeing disasters like HIV this was revealed by World Trade Organization. In April 2002 $600 million Global Fund was approval for the first round, UNAIDS still in July gave a proved that AIDS was again by far the leading source of death in sub-Saharan Africa. This makes Constitutional Court orders of South African government to produce the HIV medicine nevirapine obtainable for all the victims of HIV which includes pregnant women,

newborn children following legal test by the Treatment Action Campaign (TAC) And FDA in November same year 2002 granted its first fast HIV checking of 99.6% perfection that give answer within 20 minutes. However, Emergency Plan For AIDS Relief (PEPFAR) was set up by President George W. Bush in January 2003 and contribution of $15 billion in respect of fighting HIV prevalent for five years was initiated. Though concentration was on countries with high rate of the disease. More so world Health provided a method of 3 by 5 initiatives for curing people living with HIV. That is three million infected people will benefit for the treatment of HIV coming 2005. This prompted the Ethiopia Government to launch its payment for ART founded creativity in 2003 and free ART vision in 2005. Number of patient that started the ART treatment begging with 150,136, 208,784 and 268,934 correspondingly in 2008, 2009 and 2010; Individual receiving ART as of then resulted 109,930, 152,472 and 207,733 respectively. This generate the region to be the worst country ever seen with the highest HIV/AID cases. Adult that that were HIV incidence was 1.4% in 2005. Male Circumcision was institute in other to reduce the risk of male to female transmission of HIV by 60% in 2006. UNAIDS with World Health Organization highlighted that male circumcision have to be considered in the regions that has higher HIV and lower male circumcision incidence. By May 2007 WHO and UNAIDS circulated new regulation urging provider to commenced HIV epidemic testing in healthcare settings, the main target is to extend the knowledge. In general HIV status will greatly increase the access to the treatment and prevention while as closed to ending of 2010 the global analysis reveals that about 34 million victim of HIV were in existence. Sub Saharan from Africa have about 68% of HIV victims. However, the country that is more affected in the sub-Saharan Africa is Ethiopia with over 1.3 million HIV victims and about 277,800 individuals needful of treatment. African with the largest population of people leaving with HIV but then analysis reveals that in terms of follow-up the they are highly left behind. Region make the effectiveness of HAART to differ from one area to another because of this lead to environmental differences of disease, problem like tuberculosis or intestinal parasites, viral subtypes and also genetic imaginable disparities from drug absorption. More so in January 2010 USA lifted the ban for travelers with HIV positive to enter the country. CAPRISA 004 in July microbicide was introduced for trial and the success outcomes disclosed that the microbicide gel decreases the risk of HIV infection in women by 40%. The iPrEx trial result exhibited a reduction in the virus attainment by 44% among men that usually have sex with fellow counterpart men who took pre-exposure prophylaxis (PrEP). In another development HPTN 052

result after trial in 2011 clearly revealed that early commencement of antiretroviral treatment lessened the danger of HIV transmission by 96% between serodiscordant couples. While the FDA in August permitted Complera drugs to multiply the medication for HIV victim, this drug is the second all-in-one joined dose mixture of dosage. Base on the approval of PrEP by FDA in July 2012 for HIV positive people should stop the sexual transmission of HIV. For the first period, the majority of people qualified for receiving the therapy were (54%). UNAIDS reported in 2013 that cases related to death of HIV/AIDS had dropped to 30% since their climax in 2005. Based on estimate there were 35 million people living with the epidemic. New UNAIDS in September 2014 Fast Track targets termed for studying scaling up of HIV prevention and treatment programmes to prevent 28 million newly infected and end the outbreak by coming 2030. Nevertheless, UNAIDS also introduced the establishment of 90-90-90 pursuing the aim that 90% of people living with the epidemic to be identified while 90% of those discovered should be on antiretroviral medication also 90% of those receiving treatment should achieve viral overpowering by the year 2020. Similarly, UNAIDS also revealed that the Millennium Development Goal (MDG) in 2015 with regards to HIV and AIDS reaching six months ahead of program. The intention of MDG 6 is to stop and reverse the spread of HIV which discovered that 15 million of people were receiving treatment. Again, WHO initiated a guide for new treatment by urging that all individual surviving with the epidemic should be on antiretroviral treatment, in spite of their CD4 count immediately after been discovered. UNAIDS in October released new methods of 2016-2021 in line with the Sustainable Development Goals (SDGs), which called for speeding up with the global HIV response to accomplish the epidemic prevention and treatment focuses in other not to have discrimination. Russian people living with HIV has reached one million, showing about 64% of all new cases detected in Europe was occurred in Russia. More so UNAIDS reveal that 18.2 million people were receiving ART, comprising 910,000 children which double the number compare to five years past. Nevertheless succeeding in the increased of ART entree involves a greater risk of drug resistance and the WHO published a report on how to deal with the developing epidemic. AVERT March 2018 celebrated during its 30th anniversary participation of HIV/AIDS knowledge that they will work to empower people through information to stop the epidemic.

1.3 The prevalence past in Nigeria

The history of HIV case in Nigeria started in 1985 that was thirty something year back at that time it was a young female lady with 13 years of age that was diagnosed of the disease which was reported in 1986. Lagos state happens to be were the incidence occurred by then it was the capital city of Nigeria that has almost the highest population and industry in the country. The story at then became unbelievable, Nigerian people refused to accept the news of the HIV case because the disease was known to be for homosexuals that leaves in United States of America which is very far away to experience in Nigeria especially with our younger generation of age. Also, what people thought about the disease is that Americans were using it to convince both the gender in order not to enjoy having sex that is to discourage people about getting pleasure from sex. Debating on the issue of the origin of circumstances diseases started, some looked at it as just kind of threat to the Nigerian Government. The position of the people and government refused to accept basing that a sex worker from one of the West African countries to be the first HIV positive individual to be identified in Nigeria. Because is a foreign disease, it was mistaken and belief to be incapable of coming to affect Nigerians. The Government was reluctant gradually about the HIV issue refusing to do anything about stopping the spread of the virus. The culture and our religion perception in Nigeria also contributed to the spread of the diseases, people believe that death is pre-ordained which comes at the due time it does not have to do with change in the aspect of sex or sexual practices. With this belief as a result, silently the virus continues spreading from individual to individual, towns and villages irrespective of social class and educational background in the country. The epidemic in the country increased slowly became a generalized epidemic when it was largely thought to be focused only surrounded by a few sub-populations. The spread of the virus disease after twenty-two years of the first reported case, become a massive epidemic that resulted not only issue of health but also a socio-economic setback. Nigerian society was seriously affected because the disease killed and destroyed many lives of people in Nigerian. In 1991, the Government of Nigeria organized a National Surveys across the country in order to watch over by observing the trend and degree of the prevalent. The epidemic level as 1991 was 1.8% which increase to 5.8% in 2001 and it started reducing slightly in 2003 with 5.0% and 4.4% in 2005. The Government and people of the Federal republic of Nigeria recognize and acknowledge that the HIV/AIDS epidemic in Nigeria is on the threshold of an exponential increase in the country and

consequently are committed to accept the challenge of reducing its secured and its impact on the nation by understanding and generally accepting to take some simple measures with cost effective. There was reduction based on the estimate from 2001. A new style of epidemiological model for all developing countries was initiated by the UNAIDS/WHO. Estimation and Projection Package (EPP) was the model, it uses the surveillance data from each HIV viewpoint in estimating the HIV/AIDS rates. More so information from birth rate, death rate and output of EPP, According to USAID estimates in 2005 was achieved using Spectrum Program by then Nigeria was ranks third with the highest number of HIV infected and death across the globe. Nigeria was having 20% percent of total population of people living with HIV while 10% across the world record shows that about 3.86 million people are living with the epidemic, 221,000 accounted deaths and 370,000 people of new infected cases were reported annually. Nigeria the most popular country from Africa based on the estimated population was having about 134.5 million in 2006 and 152.6 million in 2009 at first instances of AIDS in 1986 was discovered in Nigeria. The epidemic has growing slowly, concurring to the survey conducted by the Federal Ministry of Health at then adult HIV positive was increased from 3.10% in 2009 to 3.6% in 2011. Which is extended beyond the commonly classified High risk groups of sex workers, migrant laborers and so on which is now common in the general population (Cherly Overs 2002)

1.4 Modes of force of the epidemic transmission in Nigeria

A survey that was executed by Federal Ministry of Health in Nigeria around 2003 and 2004 gave the information on the prevalence of heterosexual transmission in Nigeria was confirmed by several studies that focused on some high-risk and vulnerable groups. Generally, there are so many observed factors that leads to the spread of the HIV epidemic. This critical powerful epidemic is mostly due to interactive nature of Nigerians attitude in relating to high risk of sex, high level of poverty. Negative traditional repetitions, low levels of education, humiliation and discrimination of patients with the virus, high level of sexual deliverance infections, blood transfusion and mother to child circulation. Massive rural-urban migration with social effects and cultural practice relating to inheritance of wife due to poverty. International human trafficking especially young men and women. Another factor that may fuel the epidemic in the country is the wide range of traditional practices such as wife hospitality, sharing partner, double-crossing and wife inheritance. In 2003

the National HIV/AIDS and Reproductive Health Survey (NARHS) testified that about 18.4% of men aged 15-64 years and 9% of women aged 15-49 years were involve in extra and premarital sexual engagement. Revealed also said that youths were having serious risk of contamination with the virus which 14% were female then 25% were male, all were connected with non-marital sex. However only few uses condom while having sex (32% women and 50% men). The HIV/AIDS epidemic from the study was high in communities like Nsuka, Benue and Kogi were those with common practice. Also, several traditional practices known for transmission of HIV were female genital cutting with some traditional Consultants Doctors habits (MA Tag-Eldin-2008)

1.5 National survey study comprising International Agencies

Nine states in 1991 were among the first HIV Sentinel Surveillance conducted in Nigeria which comprised of 44 locations while the second was conducted in 1993 which involved 17 states with 64 locations. However, in 1995 surveillances was conducted in 21 states covering 84 sites while in 1999 states covered was 18 with 74 sites respectively. And also, the sentinel surveys that covers the whole 36 states in Nigeria with 85 locations was the one that accomplish in 2001, 2003 and 2005 respectively. The collaboration of some international organizations with governmental and non-governmental organization in Nigeria with regards to study of HIV/AIDS epidemic. Organization like NDHS, the National HIV/AIDS and Reproductive Health Survey (NARHS) and the Behavioral Surveillance Survey (BSS). In 1980, 1990, 1999 and 2003 the NDHS planed a survey to solicit information on the socioeconomic and health but was not about monitoring sexual behavior changes of HIV/AIDS (Bulletin of WHO).

1.6 The objectives aims of the research study

There are so many reason in Africa, especially Sub-Saharan Africa Countries that lead to HIV intervention, the virus became an issue seriously which prompt the Government of Nigeria with the collaboration of other related bodies, putting effort in preventing and controlling of epidemic of HIV/AIDS long time ago. Therefore, these objectives aims reason of this research were stated below.

1. To make use of the appliance of statistical techniques of univariate and multivariate to identify with those HIV patients undergoing follow-up.

2. To identify the survival age groups of patients receiving treatment based on their gender.

3. To discover and investigate which gender, state, marital status, occupation, age category, hospital status has the high prevalence of HIV in the Hospital.

1.7 Statement of the problem

Prevalence rate of HIV was observed for the past decade nothing has been done to completely eradicate the epidemic based on this the researcher intention is to identify the effect of the epidemic by apply multivariate statistical methods with other statistical analysis to find a profound lasting method in talking the problem of HIV. Whiteside (2008) alleged that some majors need to be put in place for preventing of HIV/AIDS, which are; Self-discipline and truthfulness to companion, using of condom protection during sex and educating people, information through awareness campaign. Furthermore, he said that the youth have the highest contact of the epidemic ranging from 15 to 49 years of age especially student in higher institution of learning.

1.8 Significance of the study

The research analysis of the study will assist in determining whether the level of HIV is decreasing or increasing so that at the end will help Government and other bodies on how to plan and control the death, spread and to prevent people with HIV in the Teaching Hospital, Gombe State and Nigeria in general when completed.

1.9 Scope and limitations of the research

The study was strictly on the reported cases recovery of Teaching Hospital Gombe State, Nigeria. With limited coverage of 5000 sample size which comprises of only HIV patient, staffs and auxiliary equipments in the Unit of the Hospital.

1.0 Abridgement table

HIV	Human Immunodeficiency Virus
MOH	Ministry of Health
STD	Sexually Transmitted Disease
AIDS	Acquired Immunodeficiency Syndrome
ART	Antiretroviral Therapy
ARV	Antiretroviral
ANC	Antenatal Care
HAART	Highly Active Antiretroviral Therapy
PLWHA	People Living with HIV/AIDS
UNAIDS	United Nations Program of HIV/AIDS
WHO	World Health Organization
NGO	Non-governmental organization
MSM	Men who have sex with men
CSW	Commercial sex worker
VCT	Voluntary counseling and testing
STI	Sexually transmitted infection
PMTCT	Prevention of mother-to-child transmission of HIV

CHAPTER TWO

2.0 Literature Review

Goffman's (1963, p.3) said this challenges that has to do with conceptualization of shame as "an element that is significantly insulting". With regards to Goffman's conceptualization of responses to HIV/AIDS victim speak of bad replies that will result to be a disgrace, dishonor, embarrassment and so on to the individual that is suspected with the virus.

(Katz; 1960 and Smith et al., 1956) based on leaving theories from preceding writers about functional attitude theories, HIV researchers formulated that peoples attitude towards infected people with the epidemic exhibit individual private concerns.

The possibility of finding a lasting solution to HIV/AID is not achieved regardless of the advancement in world of medicine. A French scientist Luc Montagnier in 1983 was the first person detected the Virus. Retroviridae family is where the retrovirus is coming from which occurs in two forms of appearances HIV-1 and HIV-2. The scientific variety of HIV disease ranges from asymptomatic which advances later to AIDS. The epidemic virus usually can be transmitted through parental contamination of blood, unprotected sex, child from his mother by means of breastfeeding. The greater risk of having contact is through etiological instruments. Even though every person that is sexually active will be a victim of infection. More so homosexual doing relating to several partners with illegal injectable prescriptions and prostitution is another means of transmission of the epidemic.

(Herek; 1985 and Pryor et al., 1989) said that private attitudes regarding to people existing with HIV/AIDS contamination point toward the needs for peoples' characters to shun the menace practice of rejecting individuals concern with the infected virus for this reason it generates about the dangerous nature of the disease.

Kleinman stated, people should expect and be ready for the embarrassment behaviours that will commence from the society, that is expect them earlier before they happen and even when they don't happen (Kleinman, 1988: p. 160).

The role of the instrumental functions for the manifestation with respect to those infected with the virus of HIV epidemic was investigated by (Gregory Herek, 1986; John B. Pryor et al., 1989). However, the position of symbolic functions that has to do with societal feedback to victims of HIV/AIDS. That is the thoughts, are expressions of one's particular profits. These characteristics of expression generally has link with virus of homosexuality immorality, and therefore the advancement of not tolerant feelings combined with homophobic opinions. In connection with Instrumentality Psychological Style of study by Crandall et al. with respect of a critical syndrome as HIV/AIDS, peoples approach concerning to those infected with the virus is nothing but fear of getting in contact with the virus.

(Gilmore & Somerville, 1994) Revealed that several human rights advocated stood up on the growing concerns of stigmatization and discrimination for those people living with HIV/AIDS in the world, because negatively is seriously affecting the well-being of infected individuals.

(Kohi and Horrocks, 1994; Lie and Biswalo, 1994; Biswalo and Lie, 1995; Powell et al., 1998). point out different views with regards to the society on those victims that mistakenly to be known with HIV. The society reject them, gossip about them, fear them blame them by rejecting them to mentioned but few because they brought shame to the family or society.

(Christian S. Crandall et al., 1997) Expressed that the HIV/AIDS linked stigmatization was influential that needs representative worries. Allowing to this development, the fear of developing with the virus inspires the advancement for destructive opinions. Though a complete structure was provided by him for clearer consideration of people attitudes with those infected HIV victims.

(Herek et al., 2003) said humiliation of HIV victims presents a major setback to the positive execution of HIV programme in terms of prevention. As long as there is convincing proof that people leaving with the epidemic are facing challenges based on the effects of individual reacting to use of voluntary counselling and testing (VCT) of HIV services, however fear of being mark out will have effects on people to comply with the use of VCT services.

(Muyinda et al., 1997; UNAIDS, 1998; Brown, et al., 2001; Nyblade et al., 2003; de Paoli et al., 2004; UNAIDS, 2004) added that some individual in the society are secretly going for HIV

counselling and testing services and they chooses the person that can keep the confidentiality of their test result of HIV.

(Lie and Biswalo, 1994; de Paoli et al., 2004). Again, said that because of humiliate and shame many people that are been tested for HIV status don't reveal their HIV result status especially when it is positive.

(Derlega et al., 2002; Duffy, 2005; Lie and Lothe, 2002; UNAIDS, 2000). HIV related humiliation on the aspect of VCT services is a well-known effect that people should foresee stigmatizing consequences even before they are really mark out.

A report from Amnesty International (2006) drawn that victims of HIV/AIDS requires to prepare for not only the virus after infection, but then also with undesirable reaction from the society which could be regularly regarded as disturbing and showing of differences. Also, related source reveal that violation of human rights in conjunction with HIV/AIDS in the Caribbean area above all is the Dominican Republic and Guyana.

CHAPTER THREE

3.0 Methodology

The study design is based on retrospective group study conducted from Gombe State Teaching Hospital, Gombe Nigeria. The study sample covered across 5000 HIV positive victims from the record unit of the Teaching Hospital whom were on antiretroviral therapy registered for treatment. However, their discovery from the beginning of getting registered for the ART at the hospital within similar period will be taken account in the study by monitoring their follow-up. Also, provision of resources allocation and optimizing care for treatment strategies that will improve their Health in the Hospital was considered. Data variable were age, sex, CD4, hematology, chemistry, hospital status, marital status, age category, state, month of last visit, month of next visit, occupation, tribe. Clinical conditions were WHO implementation of base line CD4counts, Hgb level, opportunistic diseases, joined illness, analysis/functional status. Performing of ART treatment based on types one, type two and type three. Also, the follow up investigation will consider those losing follow up, relocation to another place, culture of incomplete turnout. The accumulated variables were analyzed using Statistical Package for the Social Sciences (SPSS) software.

3.1 Logistic Regression

A prominent Statistician David Cox in 1958 established the Logistic regression which the binary logistic model is used for estimating the probability of binary response building on one or more independent or predictor variables. However, it could be seen as the occurrence of risk factor multiplies by the probability of a given outcome with some certain fraction. Also, logistic regression is used for measuring relationship among the categorical dependent variable with one or more independent variables by means of estimating probabilities with logistic function, that is the cumulative logistic distribution. As a result of it considers the same set of problems as probit regression using related methods then again uses a cumulative normal distribution curve as a substitute. In spite of this the two techniques deals with latent variable called standard logistic distribution of errors and a standard normal distribution of errors. Logistic regression is seen as

unique situation of generalized linear model and thus analogous to linear regression. Nevertheless, the model of logistic regression differs based on assumptions that is relationship between dependent and independent variables from those of linear regression. The differences between the two models could be seen, either as conditional distribution (Bernoulli distribution) instead than Gaussian distribution, for the reason that the dependent variable is binary. And the predicted values become probabilities that is restricted between 0 and 1, all through the logistic distribution function, since logistic regression is used to predict the probability of a certain outcome. The Logistic regression is another substitute to Fisher's 1936 technique, linear discriminant analysis, however when the assumptions for linear discriminant analysis is full filled, the situation could be reversed to produce logistic regression. The opposite is not real, since logistic regression does not involve multivariate normal assumption of discriminant analysis. Several disciplines use logistic regression for resolving their problem, field like social sciences, mechanical discipline, medical discipline and so on.

Logit model or Logit regression, in statistics is a regression pattern in which the dependent variable goes with categorical. The binary dependent variable goes in line with only two values, that is zero (0) and one (1), it can be characterized as pass or fail, dead or alive, lose or achieve, sick or healthy respectively. In a situation where the dependent variable has more than two results of categories the logistic regression can take either multinomial, binomial and ordinal form. Furthermore, binomial regression or binary logistic is used in a situation where by the detected result for the dependent variable based only on two possible figures which is zero and one outcomes, it could represent the practice of living or not-living, infection or not-infection and so on. What distinguished logistic regression with other form of standard linear regression and from other types of regression analysis is the used for binary valued outcomes, is the way the probability of a certain outcome will then be connected to the linear predictor affair. Logistic regression generally remained from the class of statistical representations term as generalized linear models. In broad sense the models consist of ordinary regression, ANOVA, multivariate statistics such as ANCOVA and log linear regression and so on. Logistic regression permits one to forecast discrete outcome or set of participants from a set of variables that could be continuous, dichotomous etc. usually the dependent or response variable may be dichotomous, in a case like presence or absence of disease, record of success or failure. The independent or predictor variables used in logistic

regression can withstand any structure, logistic regression makes no theory about the distribution on independent variables. Also, it does not go along with a normal distribution, is not linear and those not have equal variance in each group. Also, the connection between the predicted and response variables is not linear function in logistic regression, instead, the logistic regression function is used, which is usually to be logit transformation of θ:

$$\theta = \frac{e^{(\alpha+\beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_i x_i)}}{1+e^{(\alpha+\beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_i x_i)}}$$

where; α is the constant from the equation, β represent the coefficient of the predictor.

logistic regression calculation alternatively can be represented as

$$\text{logit}\left[\theta(\mathrm{X})\right] = \log\left[\frac{\theta(x)}{1-\theta(x)}\right] = \alpha + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_i x_i$$

The dependent variable in logistic regression can perform with dichotomous outcome, in which the dependent variable could represent the probability of success (θ), with zero the probability of failure ($1-\theta$). This category of variable is known as Bernoulli or binary variable.

3.1.1 The Logistic Equation

Logistic formulations are specified through the probability of $Y=1$, which is denoted as $\hat{p}$, the probability that Y is 0 becomes $1-\hat{p}$. However ln symbol signifies as natural logarithm while $\beta_0+\beta_1 X_1$ is the recognizable equation for the line of the regression , also P will be calculated from the regression equation, by realizing the regression equation, theoretically we can determine the expected probability for $Y=1$ from a given value of X as;

$$\hat{P} = \frac{\exp(\beta_0+\beta_1 X)}{1+\exp(\beta_0+\beta_1 X)} = \frac{\ell^{\beta_0+\beta_1 x}}{1+\ell^{\beta_0+\beta_1 x}}$$

Were; ℓ denote to be the exp which is the exponent function

$$\frac{\text{Odds(if the matching variable added by 1)}}{\text{Odds (if the variable not added)}} = \frac{p(event \mid x+1)/(1-p(event) \mid x+1))}{p(event \mid x)/(1-p(event) \mid x))}$$

Formula for assissting of Y from logit estimates $Y = \dfrac{\exp(X\beta)}{1+\exp(X\beta)}$

$$\text{logit } (Y) = natural \log(oddss) = \ln\left(\frac{\pi}{(1-\pi)}\right) = \alpha + \beta X$$

$\pi = \text{probabilit y}$ (Y is the outcomes of interest while X is specific value of x)

$$\text{logit } (Y) = \ln\left(\frac{\pi}{(1-\pi)}\right) = \alpha + \beta_1 X_1 + \beta_2 X_2$$

Therefor $\pi = \text{probabilty}$ (Y is the outcomes of interest while $X_1 = x_1, X_2 = x_2$)

$$= \frac{\ell^{\alpha + \beta_1 X_1 + \beta_2 X_2}}{1 + \ell^{\alpha + \beta_1 X_1 + \beta_2 X_2}}$$

$$\pi_i = F(\eta_i) = \frac{\ell^{\eta i}}{1 + \ell^{\eta i}}$$

Standard Logistic Regression distribution of inverse $\pi_i = F^{-1}(\pi_i) = \log \dfrac{\pi_i}{1-\pi_i}$

The Logistic Regression model is usually handle the forecasting of the logit which is the natural log of odds of considering one or the other conclusion.

That is $\ln(ODDS) = \ln\left(\dfrac{\hat{Y}}{1-\hat{Y}}\right) = a + bX$

Where; $\hat{Y}$ can be used for the prediction of probability that the event coded with 1 recommence the research if possible with 0 stopping the research. $1-\hat{Y}$ represent the predicted probability for additional finding, and X represent the predictor variable.

Reasons that made logistic regression analysis not be relevant

There are negative estimated values rarely in practice, ordinary least square implication tests are in system, very intimate to their logistic equivalents. It is advisably to run ordinary least square for any problem before going ahead with logistic regression and then lastly with regards to ordinary logistic regression, preferably the logistic regression coefficients are indifferent to marginal distributions which is very significant in practical setting of reasonable study between region and between periods.

The logistic regression uses the fundamental structure that was already been developed by linear regression in which the probability will be model by p_i using a linear predictor function , The model nature of logistic regression could be seen in the regression coefficients β_0, $\beta_1 \ldots \beta_m$ that can be put together taken with single vector β of size $m+1$. however for every data point i, further explanatory artificial variable X_0 will be add up by a standing value of 1, fitting in to the intercept coefficient β_0. And then the resulting explanatory variables $X_{0.i}$, $X_{1.i}$, . . . , $X_{m.i}$ will be also grouped into single vector X_i of size $m+1$. The probabilities p_i and the regression coefficients are ignored , while the process of establishing them is not part of the model typically determination is by some class of optimization method, for example maximum likelihood estimation which finds values that would best fit the data. This will grant perfect projections for the previously observed data. In logistic regression, B_j signifies the parameter of estimate like the additive power on the log of the odd for a unit transformation in the j_{th} clarifying variable while in a situation of any dichotomous variable like sex is the approximation of the odds of having the result for say female to be related with male. Another corresponding formula that utilizes opposite to logit is the logistic function which could be written as probability distribution precisely probability mass function.

3.1.2 Logistic Regression Assumptions

There is no correctly expression of the model which is the real conditional likelihood of the logistic function in the independent variables, there is no omission of significant variables, involving of extraneous variable is not possible and then measurement of independent variable is done without error. More so there is independent of cases, however the independent variables are not linear combinations of each other while each combination of the independent variables is not going to be linear yet it provides impossible estimation with accurate multicollinearity and then also strong multicollinearity yielding the assessments to be inaccurate. In terms of data structure, it goes with continuous against discrete, the Probit regression is applied in a condition that the dependent variable is binary. There are different assumptions concerning the traditional regression and logistic regression, while the population means for the dependent variables at each point of the independent variable will not be on a straight line that is linearity is not realistic. The variance of errors is not permanent, telling no homogeneity of variance however the errors are not normally distributed, revealing normality is not possible. In respect of Maximum Likelihood Assessment is used relatively than the least squares estimate used in the traditional multiple regression. However, there is universal form of distribution of assumption. Again there is establishment of numbers for the estimated parameters to be manipulated also the likelihood of the sample derived from a population with those computed parameters. And there is iteratively modification of parameters for the predictable values till the maximum likelihood value for the estimated parameters is achieved. Thus the, Maximum Likelihood methods attempt to discover the estimates of parameters that make the actual observed data most likely.

3.1.3 Interpreting Logistic Coefficients

Slope in Logistic coefficients could be understood as the effect of a unit of transformation in the variable X on the forecast logits with the other variables in the model kept constant. On the other hand, it shows how a unit change in X will influences the log of odds when the other variables in the model maintained constant. Coefficient of logistic regression at the end of any model fitting the researcher may perhaps intend to assess the influence of individual predictors by examining the regression coefficients. In the case of linear regression, the regression coefficients stand for the

change in the situation for each unit change in the predictor. However, the impact of the regression coefficient is measured by performing the operation of t-test. while the situation of logistic regression, regression coefficients stand for the change in the logit for each unit change in the predictor, realized that the logit should not be inherited. Researchers focuses mainly on the effect of predictors on the exponential function of the regression coefficient, the odds ratio. In spite of this, there are numerous tests invented to determine the impact of individual predictor, above all are the likelihood ratio test with Wald statistic.

3.1.4 Symbol of Logistic Regression

Logistic regression handles the probability functions of the following symbol

$$\pi(x) = \frac{\exp(\alpha + \beta_x)}{(1+\exp(\alpha + \beta_x))}$$

Death in logistic model provide the probability as

$$\pi(x) = \frac{\exp(\alpha + \beta_x)}{(1+\exp(\alpha + \beta_x))}$$

Hence $1-\pi(x) = \text{death probability}$

$$= \frac{1+\exp(\alpha + \beta_x) - \exp(\alpha + \beta_x)}{1+\exp(\alpha + \beta_x)} = \frac{1}{(1+\exp(\alpha + \beta_x)}$$

which the odd for the death can be $\frac{\pi(x)}{(1-\pi(x))} = \exp(\alpha + \beta_x)$

The log of odds for the death represent by $\log\left(\frac{\pi(x)}{(1-\pi(x)}\right) = \alpha + \beta_x$

3.1.5 Symbol of the Logit Function

The logit function for any number π between zero and one is define as

$$\text{logit } (x) = \log\left(\frac{x}{(1-\pi)}\right)$$

$$Let \quad d_i = \begin{cases} 1: i^{th} \quad patient\, death \\ 0: i^{th} \quad patient living \end{cases}$$

x_i is the outcomes the i^{th} patient,

then the likely value for d_i is $E(d_i) = \pi(x_i) = P_r[d_i = 1]$

The logistic regression can also be rewriting as $\text{logit}\,(\mathrm{E}(\mathrm{d_i})) = \pi(\mathrm{x_i}) = \alpha + \beta_{\mathrm{x_i}}$ or

$Y_i \sim Bernoulli\,(\pi_i) = \pi_i = \frac{1}{1+\ell^{-X_i\beta}}$ or $Y_i \sim f(\theta_i, \alpha) = \theta_i = g(X_i, \beta)$

Model $Y_i \sim Bin\,(\eta_i, \pi_i)$, $with\ \pi_i = \frac{\exp(\beta_0 + \beta_1 x_i)}{1+\exp(\beta_0 + \beta_1 x_i)}$, Want to test $H_0 : \beta_i = 0$

This calculation describes a relatives of $p = \left(\frac{1}{(1+\exp(-\text{logit}))}\right)$ $p = \frac{1}{(1+\exp(-\text{logit}))}$

$$p = \frac{odds}{(1+odds)}$$

$$\text{logitistic regression} = \ln\left(\frac{p}{(1-p)}\right) = \sum_{k=0}^{k=n} \beta_k x_{ik}$$

$\exp(\text{logit}) \Rightarrow odds$ $\ln(odds) \Rightarrow \text{logit}$

$$1 = p \quad and \quad 0 = 1 - p$$

3.1.6 Logit as Opposed to Probit

The Logistic and Probit models differs based on belief about the distribution of the errors

Logit:-Standard logistic distribution of errors

$$\log = \ln\left(\frac{p}{(1-p)}\right) \text{ or } \ln\left(\frac{p_i}{(1-p_i)}\right) = \sum_{k=0}^{k=n} \beta_k \, x_{ik}$$

Probit :- Normal distribution of errors

$$\Phi^{-1}(p_i) = \sum_{k=0}^{k=n} \beta_k \, x_{ik}$$

3.1.7 The logit against probit study

1. It handles the form of dichotomous dependent variable
2. It is requires a link function $F(Y)$ proceeding from the original Y to continuous Y'

$$\text{Pr}obit : F(Y) = \Phi^{-1}(Y) \quad , \quad Logit : F(Y) = \log\left[\frac{Y}{(1-Y)}\right]$$

3.2 Mean or Ways of Analyzing Logistic Regresion

3.2.1 Multinomial Logistic Regression

Logistic regression could be analyzed via multinomial logistic regression. It deals with the nature of multi way categorical dependent variable of an unordered values that refers to classification. However in the situation of having a dependent variables with more than two values is characterized as multinomial logistic regression. The Y accommodates more than 2 categories, However it those not consider the ordered arrangement like disease A or disease B or disease C , that is, it deals with situations where the result may have three or more likely categories.

Multinomial logistic model is define as $Multinomia\, l(\pi_i)$ $\pi_i = \dfrac{\ell^{X_i \beta_k}}{\sum_{k=1}^{n} \ell^{X_i \beta_k}}$

3.2.2 Ordinal Logistic Regression

Ordered logistic regression or ordered logit considered dependent variables that is ordered values. It goes with dependent variables that is in ordered form. The binary logistic regression outcome is normally coded as 0 or 1, which the interpretation becomes the best and simple. For instance, in a certain end of observed result for a dependent variable in which possible outcome, that is described as success can typically be codded as 1 while the outcome referring to as failure will be codded as 0. Also, the Ordered logit Y has more than 2 categories which could be ordered also, the model is regularly used for knowledge by means of result. when the multiple categories are ordered from then ordinal logistic regression should be used. In this case it uses the form of qualitative response or discrete type.

3.2.3 Mixed Logistic Regression

Mixed logit is the more advancement of multinomial logit that usually acknowledges for correlations between the selections of the dependent variable. The improvement over logistic model for setting an interdependent variable is the conditional random position.

3.2.4 Conditional Logistic Regression

In the Conditional logistic regression Y uses more than two categories that can be mounted on multiple magnitudes. However, the conditional logistic regression deals with stratified data especially when the strata are small. particularly it is used in the analysis of observational surveys. Interesting the model is used in choice of political party, occupational selection, educational background and so on.

3.3 The Odds in Opposition to Logistic Regression

The Odds is a fraction of two corresponding probabilities with a property of single variable. The odds of the dependent variable corresponding to an event as a result of linear combination of predictors is equal to the exponential function of the linear regression representation. However, the clarification on how the logit serving as a link function between the probability and the linear regression expression. Particularly that the logit ranging between a positive and a negative infinity by providing satisfactory condition upon which to perform a linear regression and then the logit

will be easily changed back into the odds. The Odds in Logistic regression, Logistic regression is used for the prediction of odds being an event based on the values of the independent variables (predictors). Odds in logistic regression can be distinct as the probability that a specific result is a case divided by the probability that is a non-case. More so logistic regression generates by using one or more predictor variables that may perhaps either one categorical or continuous. Not like the ordinary linear regression, However Predicting of binary dependent variables is used by logistic regression considering the dependent variable as the outcome of a Bernoulli trial instead than a continuous outcome. Given this transformation, the expectations of linear regression are violated with this regard, the residuals cannot be normally distributed. Furthermore, linear regression could make incredible estimates for a binary dependent variable. A way forward is to transform the binary variable into a continuous one which will take on any real value to be positive or negative. To achieve this the logistic regression first takes the odds of the event that is happening for different stages of each independent variable, then again takes the percentage of those odds that is continuous, however should not be negative then again takes the logarithm of that ratio. This is signified as logit or log odds for generating a continuous condition as a changed variety of the dependent variable. In consequence the logit transformation is demoted as link function in logistic regression granting that the dependent variable in logistic regression is binomial, however the logit is a continuous measure, upon which the linear regression is conducted. The logit of success is also put in to the predictors by using linear regression analysis. Though the predicted value of the logit will be transformed back into predicted odds by means of inverse of natural logarithm, such as exponential function. Therefore, the discovered dependent variable in logistic regression will be 0 or 1, the logistic regression is been estimated by the odds, the same as the continuous variable, the dependent variable is a success one. Usually in some applications what is needed are the odds, while others use yes or no estimate is required regardless the dependent variable is or is not a case. However, the categorical estimate will be centered on the calculated odds for the success,

Mathematically the Odds is defined by $odds = \frac{p}{(1-p)}$

Where; $\exp(\text{logit}) \Rightarrow odds$, $\ln(odds) \Rightarrow \text{logit}$, $1 = p$ *and* $0 = 1 - p$

3.4 Odds Ratios Contrary to Logistic Regression

The degree of relationship between an exposure coupled with an outcome refers to (OR). Also, it signifies the odds that a result will occur given a certain exposure, relating to the odds of result outcome occurring in the absence of any exposure. After the computation of the logistic regression, the regression coefficient (b_1) is the expected increase in the log odds of the end result per unit increase in regard to the exposure. On the other hand, the exponential function of the regression coefficient (ℓ^{b1}) denote the odds fraction related with one-unit increase in the exposure. Odds proportion (OP) or Odds ratio (OR) can be seen as the likelihood or risk of an event for experiencing the number of problem divided by the number of whom may not possibly experience the problem. Again, the term odds is can be anticipated by a fraction or ratio of number of possibility that the event of interest will happen to the number of possibility that it will not going to happened. The Odds ratio is a ratio that has link among two variables, it can be used for measuring the relative odds of the occurrence of any outcome of interest like disorder or illness, assigning exposure to the variable of interest, that has to do with health aspect or medical precedent. However, the odds fraction is used in resolving whether a certain exposure is a risk factor for a specific outcome, then comparing it with the degree of several risk factors for that outcome. The Odds ratio's in terms of variance is very sensitive to marginal weights, it has a great significance in relation to control studies and in-comparative characteristics study of changes or differences, for instance voting, occupation and so on.

$OR = 1$ There is no effect of exposure on the odds outcomes

$OR > 1$ Exposure has a linked through higher odds of outcome

$OR < 1$ Exposure has an association through lower odds of outcome

$OR = \frac{a/c}{b/d} = \frac{ad}{bc}$, Where; a is exposed sum of cases, b is exposed sum of non-cases, c is unexposed sum of cases d is unexposed sum of non-cases

$$OR = \frac{(n)\ \exp osed\ cases / (n)\ un\exp osed\ cases}{(n)\ \exp osed\ non-cases / (n) un\exp osed\ non-cases}$$

$$OR = \frac{(n)\ \exp osed\ cases\ \mathrm{X}\ (n)\ un\exp osed\ non-cases}{(n)\ \exp osed\ non-cases\ X\ (n)un\exp osed\ cases}$$

$$OR = \frac{\exp\ (\beta_0) \times \exp(\beta_1)}{\exp\ (\beta_0)} = \exp(\beta_1)$$

3.5 Generalized linear models (GLM) and Generalized additive models (GAM)

Logistic regression is a comprehensive component from a back ground of Generalized Linear Models (GLMs), in which the conditional distribution of the response will have influence in various form of parametric family, however the parameters are group by the linear predictor. The ordinary least-squares regression uses Gaussian response. It has mean equal to the linear predictor with constant variance. Generalized Additive Models (GAMs):- Is another stage outside the generalized linear models, where instead of making use of the transformed mean response with a linear function of the inputs, it will be created with additive function of the inputs. This means it link a function that will fit additive models with likelihood maximization. Generalize linear model can be defined symbolically as Y_1 , Y_2 , . . . , Y_n independent variable from the same distribution of exponential family is seen as;

1. In terms of pmf or pdf $f(y_i;\theta_i)=c(y_i;\phi)\exp((\theta_i y_i - a(\theta_i))/\phi)$
2. and the expectations produce as $\mu_i = a'(\theta_i)$
3. $\eta_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2}. \ . \ . + \beta_p x_{ip} = \beta' x_i$ stand for the linear predictors
4. $g()$: take place of the link function
5. $\mu_i = \mathrm{E}[Y_i]$ be the expectation combine with the linear predictor through $g(\mu_i) = \eta_i$

Note that μ_i depends on the (the vector) β through $g(\mu_i) = \eta_i$, *That is* $\mu_i = g^{-1}(\eta_i)$.

$\therefore \theta_i$ similarly

depends on vector (β) around $\mu_i = a'(\theta_i)$.

3.6 Maximum Likelihood Estimation

3.6.1 Likelihood Function for Logistic Regression

The main purpose of the logistic regression is for the computation of probabilities, instead than just categories, it can be fitted via the likelihood. In each of the data, there is a vector characters x_i, with an observation of y_i. Then the probability that class will either be p when $y_i = 1$ or $1-p$ when $y_i = 0$. Therefore, the Likelihood is defined by,

$$L(\beta_0\ ,\ \beta) = \prod_{i=1}^{n} p(x_i)^{yi}(1-p)(x_i)^{1-yi}$$

While the log - likelihood transform the product to sum

$$\ell(\beta_0\ ,\ \beta) = \sum_{i=1}^{n} y_i \log\ p(x_i) + (1-y_i)\ \log 1 - p(x_i)$$

$$= \sum_{i=1}^{n} \log 1 - p(x_i) + \sum_{i=1}^{n} y_i \log \frac{p(x_i)}{1-p(x_i)}$$

$$= \sum_{i=1}^{n} \log 1 - p(x_i) + \sum_{i=1}^{n} y_i\ (\beta_0 + x_i.\ \beta) \text{ specifically } = \sum_{i=1}^{n} - \log 1 + \ell^{\beta_0 + x_i \beta} + \sum_{i=1}^{n} y_i\ (\beta_0 + x_i.\ \beta)$$

Naturally to discovered the maximum likelihood estimate, is to differentiate the log likelihood with particular to the parameters, before working out the deviation will be set as equal to zero. Commencing the derivation with regards to one element of β say β_j.

$$\frac{\partial \ell}{\partial \beta_i} = -\sum_{i=1}^{n} \frac{1}{1+\ell^{\beta_0 + x_i \beta}} \ell^{\beta_0 + x_i \beta x_{ij}} + \sum_{i=1}^{n} y_i\ x_{ij} = \sum_{i=1}^{n} (y_i - p\,(x_i; \beta_0\ \beta))\, x_{ij}$$

Considering logistic regression with more than two sets let's assume Y will withstand on more than two outcomes say k of them, logistic regression could still be used. In place of exhibiting one set of parameters β_0, β every group C in O; (k-1) will have its own balance $\beta_0^{(c)}$ while vector $\beta_0^{(c)}$ and the predicted conditional probability becomes.

$$P_r(Y = C \left| \vec{X} = x \right.) = \frac{\ell^{\beta_0^{(c)} + x_i \beta^{(c)}}}{\sum_k \ell^{\beta_0^{(c)} + x_i \beta^{(c)}}}$$

Checkmating the case of dealing with two group zero and one, the equation reduces by $\beta_0 = \beta_0^{(1)} - \beta_0^{(0)}$ *and* $\beta = \beta^{(1)} - \beta^{(0)}$

Generally, the regression coefficients are predictable by means of maximum likelihood estimation. Not like linear regression with normally distributed residuals, it will not be workable to find a closed method representation for the value of coefficient that maximize the likelihood function, so that an iterative means should be used as an alternative like Newton's methods. The procedure starts with experimental answer, with little amending to see if there is improvement, then also repeats this amendment till no more progress is created, at a certain point the process is said to be converged. In several occurrences the example may not get to convergence, when the model is not convergence there is an indication that the coefficients are meaningless, because solution for right achievement for the iterative process was not capable to discover. Reason why converge failure may occur could be due to the presence of large ratio of predictors to events multicollinearity, shortage, or thorough separation. When there is a large ratio of variables to cases that results in extremely conservative can lead to non-convergence. Unsatisfactorily high correlations among predictors is term as multicollinearity however as if there is increase in multicollinearity, the coefficients will remain unbiased then again, the standard errors tend to increase at the same time the likelihood of model convergence reduces. For a multicollinearity to be dictated between predictors there is need for performing a linear regression analysis alongside the predictors of consideration for the reason to investigate the tolerance statistic that is used in measuring whether multicollinearity is unsatisfactorily high.

3.6.2 Likelihood for GLM

Given that $(Y_i - s)$ are independent with pdf or pmf $f(y_i;\theta)$ then the likelihood is define as $L(\beta,\phi) = \prod_{i=1}^{n} f(Y_i,\theta_i)$ is similarly the function of the regression coefficient $\beta^{i=1}$ as θ_i is a function of μ_i which is the advance function of β.

The contribution of the log likelihood from the i^{th} observation is $l_i(\beta) = \log(f(y_i;\theta))$ while the log likelihood is symbolized as $l(\beta,\phi) = \sum_{i=1}^{n} l_i(\beta,\phi) = \sum_{i=1}^{n}\left[\frac{\theta_i Y_i - a(\theta_i)}{\phi} + \log\left(C(Y_i;\phi)\right)\right]$

3.7 GLM model is also the opposite of Logistic Regression model define by

1. $(Y_i - s)$ as the response variable from binomial distribution $Bin\ (n_i, \mu_i)$
2. $\eta_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \ldots + \beta_p x_{ip}$ represent the linear prediction
3. $\mathrm{E}[Y_i] = \mu_i = \eta_i \ \frac{\exp(\eta_i)}{1+\exp(\eta_i)}$
4. $g(\mu_i) = \log\left(\frac{\mu_i}{\eta_i - \mu_i}\right)$ is the representation of the link function
5. $\pi = \frac{\mu}{n}\ that\ is\ g(\pi_i) = \log\left(\frac{\pi_i}{1-\pi_i}\right)$ represent the function (link function for binomial proportion) $\frac{Y_i}{n_i}$
6. $\log\left(\frac{\pi_i}{1-\pi_i}\right) = \log it\,(\pi)$ term as logit function

3.8 The Linear Regression model could be seen as

1. $(Y_i - s)$ symbolizing the response variable from the normal distribution
2. $\eta_i = \beta_0 + \beta_1 x_{i1} + . \ . \ . + \beta_p x_{ip}$ represent the linear predictors
3. $\mathrm{E}[Y_i] = \mu_i = \eta_i$ which is the link function
4. $g(\mu_i) = \mu_i$ be the identity function

3.9 The connection functions for binomial data

1. $\pi = g^{-1}(\eta) = \dfrac{\exp(\eta)}{1 + \exp(\eta)}$ represent logit link function that is $g^{-1}(\eta)$ denote the cumulative distribution function for a continuous distribution.
2. It is continuous and also increasing very strictly
3. $g^{-1}(-\infty) = 0 \ and \ g^{-1}(\infty) = 1$
4. $g(\pi) = F^{-1}(\pi)$ is the general link function where; $F()$ is refers to as continuous CDF

3.9.1 Binomial data for other combine functions

1. In general, the substitute for the logit is the Probit –link which is define as

   $g_2(\pi) = \Phi^{-1}(\pi)$

   Where $\Phi(\eta) = \int_{\infty}^{\eta} \dfrac{\exp\left(-x^2/2\right)}{\sqrt{2\pi}} dx \ is \ the \ CDF \ of \ zero \ and \ one$
2. $g_3(\pi) = \log(-\log(1-\pi))$ signify another alternative corresponding $\log - \log - link$ which is the inverse of $F(\eta) = 1 - \exp(-\exp(\eta))$ which also known as the Gumbel distribution.

3.10 Poisson Regression related to functions

The Poisson regression is applicable for the uses of counts data without any upper limit, gamma regression, etc.

1. $Y_i \sim P_0(\mu_i)$
2. $\eta_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \ldots + \beta_p x_{ip}$ is the linear predictor
3. Normal link function is given by $\eta_i = g_0(\mu_i) = \log(\mu_i)$ *which gave* $\mu_i = \exp(\eta_i)$
4. $\eta_i = \dfrac{g_1}{2(\mu_i)} = \sqrt{\mu_i}$
5. $\eta_i = g_p(\mu_i) = \mu_i^p$

3. 11 Canonical Link Function

1. μ_i depends on vector (β) through $g(\mu_i) = \eta_i$
2. $\therefore\ \theta_i$ depends on β through $\mu_i = a'(\theta_i)$
3. Mathematically GLM turn out to be easier if we assume that the canonical parameter θ_i stand for the linear prediction η_i
4. $g(\mu_i)$ represent the link function called canonical
5. Then $\mu_i = g^{-1}(\eta_i) = g^{-1}(\theta_i)$
6. Since $\mu_i = a'(\theta_i)$ signify the canonical link function obtained from $g^{-1}(\theta_i) = a'(\theta_i)$

3.12 Canonical Link Function Examples

1. $a'(\theta) = \theta = g^{-1}(\theta)$ which produced $g(\mu) = \mu$ is term as the normal distribution that is ordinary linear normal model.

2. $a'(\theta) = \exp(\theta) = g^{-1}(\theta_i)$ which gave $g(\mu) = \log(\mu)$ is describe as the Poisson distribution that is the log linear model.

3. $a'(\theta) = \dfrac{\exp(\theta)}{1+\exp(\theta)} = g^{-1}(\theta_i)$ which yielded as $g(\pi) = \log\left(\dfrac{\pi}{1-\pi}\right) = \log it(\pi)$ designated as the binomial distribution with $n = 1$ *that is* $\mu = \pi$

3.13 Estimating of the β

$\dfrac{\partial l(\beta)}{\partial \beta_j}$ is the score function

Where; $S(\beta) = (S_1(\beta), \ldots, S_p(\beta))'$ stand for j element in the score function

$$S_j(\beta) = \frac{\partial l(\beta)}{\partial \beta_j} = \sum_{i=1}^{n} S_{ij}(\beta) = \frac{1}{\phi}\sum x_{ij}\ \frac{Y_i - \mu_i}{g'(\mu_i)V(\mu_i)}$$

MLE $\hat{\beta}$ will be achieved by solving

$$S_j(\hat{\beta}) = \frac{1}{\phi}\sum x_{ij}\ \frac{Y_i - \hat{\mu}_i}{g'(\hat{\mu}_i)V(\hat{\mu}_i)} = 0\ ,\ for\ j = 1 \ldots P.$$

Where; $\hat{\mu}_i$ is the likely expectation with $\beta = \hat{\beta}$ is capable of reducing ϕ, then the MLE of β does not depend on the rate of the ϕ.

3.14 Contribution of score function

In any observation is been discovered by the chain rule and the rule of the derivative of an inverse function.

$$S_{ij}(\beta) = \frac{\partial l(\beta)}{\partial \beta_j} = \frac{\partial \eta_i}{\partial \beta_j} \frac{\partial \mu_i}{\partial \eta_i} \frac{\partial \theta_i}{\partial \mu_i} \frac{\partial l_i}{\partial \theta_i}$$

Where; $\frac{\partial \eta_i}{\partial \beta_i} = x_{ij}$, $\frac{\partial \mu_i}{\partial \eta_i} = \frac{1}{\frac{\partial \eta_i}{\partial \mu_i}} = \frac{1}{\frac{\partial g(\mu_i)}{\partial \mu_i}} = \frac{1}{g'(\mu_i)'}$

$$\frac{\partial \theta_i}{\partial \mu_i} = \frac{1}{\frac{\partial \mu_i}{\partial \theta_i}} = \frac{1}{\frac{\partial a'(\theta_i)}{\partial \theta_i}} = \frac{1}{a''(\theta_i)} = \frac{1}{V(\mu_i)}$$

$$\frac{\partial l_i}{\partial \theta_i} = \frac{\partial \left[(\theta_i Y_i - a(\theta_i))/\phi + \log(C(Y_i)) \right]}{\partial \theta_i} = \frac{Y_i - \mu_i}{\phi}$$

which at the end will give $S_{ij}(\beta) = \frac{1}{\phi} x_{ij} \frac{Y_i - \mu_i}{g'(\mu_i) V(\mu_i)}$

$$S_j(\beta) = \frac{\partial l(\beta)}{\partial \beta_j} = \sum_{i=1}^{n} S_{ij}(\beta) = \frac{1}{\phi} \sum x_{ij} \frac{Y_i - \mu_i}{g'(\mu_i) V(\mu_i)}$$

Hint $E[S_j(\beta)] = 0$ meanwhile $E[Y_i - \mu_i] = 0$. These calculations will not be work out logically except in OLR with normal distribution and then also identity link. Hence it is normally solved by numerical optimization.

3.15 Numerical optimization

It has been manipulated either by Newton Raphson or Fishers Scoring Algorithm

Newton Raphson Algorithm is described symbolically as

$$\beta^{(S+1)}) = \beta^{(S)} + [J(\beta^{(S)})]^{-1} S(\beta^{(S)})$$

Where; $S(\beta)=\frac{\partial l(\beta)}{\partial \beta}$ denote the score function

$$J(\beta)=\frac{\partial^2 \mathrm{I}(\beta)}{\partial\beta\,\partial\beta^T} \qquad \text{be the noted information matrix}$$

Fishers Scoring Algorithm symbolically define by

$$\beta^{(S+1)})=\beta^{(S)}+[\mathrm{I}(\beta^{(S)})]^{-1}S(\beta^{(S)})$$

$\mathrm{I}(\beta)=E[J(\beta)]$ represent the expected information matrix where; the $\mathrm{I}(\beta)$ refers to the Fishers information.

3.16 The observed information matrix

$$\mathrm{J}(\beta)=\left\{\mathrm{J}_{ik}(\beta)\right\}$$

where; $\mathrm{J}_{ik}(\beta)=-\frac{\partial^2 l}{\partial\beta_j\partial\beta_k}=-\frac{\partial S_j}{\partial\beta_k}$

where; $=-\frac{1}{\phi}\sum_{\mathrm{i}=1}^{\mathrm{n}} x_{ij}\,\frac{\partial[(\mathrm{Y_i}-\mu_\mathrm{i})/(\mathrm{g}'(\mu_\mathrm{i})\mathrm{V}(\mu_\mathrm{i}))]}{\partial\beta_k}$

$$=-\frac{1}{\phi}\sum_{\mathrm{i}=1}^{\mathrm{n}} x_{ij}\,\frac{\partial\eta_i}{\partial\beta_k}\frac{\partial\mu_i}{\partial\eta_k}\,\frac{\partial[(\mathrm{Y_i}-\mu_\mathrm{i})/(\mathrm{g}'(\mu_\mathrm{i})\mathrm{V}(\mu_\mathrm{i}))]}{\partial\mu_i}$$

$$=-\frac{1}{\phi}\sum_{\mathrm{i}=1}^{\mathrm{n}} x_{ij}\,x_{ik}\,\frac{1}{g'(\mu_i)}\,\frac{\partial[(\mathrm{Y_i}-\mu_\mathrm{i})/(\mathrm{g}'(\mu_\mathrm{i})\mathrm{V}(\mu_\mathrm{i}))]}{\partial\mu_i}$$

And $=\frac{\partial[(\mathrm{Y_i}-\mu_\mathrm{i})/(\mathrm{g}'(\mu_\mathrm{i})\mathrm{V}(\mu_\mathrm{i}))]}{\partial\mu_i}$

$$=\frac{1}{(\mathrm{g}'(\mu_\mathrm{i})\mathrm{V}(\mu_\mathrm{i})}\frac{\partial(\mathrm{Y_i}-\mu_\mathrm{i})}{\partial\mu_i}+(\mathrm{Y_i}-\mu_\mathrm{i})\frac{\partial[1/(\mathrm{g}'(\mu_\mathrm{i})\mathrm{V}(\mu_\mathrm{i})\,]}{\partial\mu_i}$$

$$=\frac{-1}{g'(\mu_i)V(\mu_i)}+ (Y_i - \mu_i)\frac{\partial[1/(g'(\mu_i)V(\mu_i))]}{\partial\mu_i}$$

3.17 Estimating of ϕ

It could be statistically maximized, the ϕ can be estimated via the method of moment. It can be estimated by the maximum likelihood and MLE of β does not depend on the value of ϕ, however when the β is plugged to the likelihood it will give a profile likelihood for ϕ and then also the MLE of ϕ is obtained thru maximizing as;

$$\tilde{l}(\phi) = l(\hat{\beta},\phi) = \sum_{i=1}^{n}\left[\frac{1}{\phi}\hat{\theta}_i y_i - a(\hat{\theta}_i) + \log(C(y_i;\phi))\right]$$

3.18 Technique of large sample

The properties of the estimate uses the standard error, confidence interval and test of hypothesis. However the large sample result for MLE of β in a GLM could be seen when β is p-dimensional and number of observations are large then we can have $\hat{\beta} \approx N_p(\beta, I(\beta))$. Again it can be used for the creation of CI for each component in β, for the linear predictor η_i for given X - values and for $\mu_i = g^{-1}(\eta_i)$, can then be plug in the MLE ($\hat{\beta}$) . This is also the origin for the Wald test.

$S(\beta) \approx N_p((O, I(\beta))$ is a large sample outcome for the score function in a GLM . The central limit theory is where the normal distribution comes from . The J^{th} component of

$$S_i S_j(\beta) = \frac{1}{\phi}\sum_{i=1}^{n} x_{ij}\frac{Y_i - \mu_i}{g'(\mu_i)\ V(\mu_i)}\ ,\ \ E[S(\beta)] = 0 \quad \text{since } E(Y_i - \mu_i) = 0$$

Proving of covariance matrix will be seen as $Cov(S_j S_k) = E(S_j S_k)$

$$= \frac{1}{\phi^2}\sum_{i=1}^{n}\frac{x_{ij}x_{ik}}{g'(\mu_i)^2 V(\mu_i)^2} Var(Y_i - \mu_i) \quad = \frac{1}{\phi}\sum_{i=1}^{n}\frac{x_{ij}x_{ik}}{g'(\mu_i)^2 V(\mu_i)} = I_{jk}$$

3.19 Multivariate normal distribution

$Y = (Y_1, \ldots Y_P)'$ signifying a p-dimensional vector

$Y = AZ + \mu$ is defined as multivariate normal distribution

where; $Z' = (Z_1, \ldots Z_P)'$ indicating the vector of P independent $N(0\ and\ 1)$

Z_i, $\mu' = (\mu, \ldots \mu_P)$ represent the variable of systematic p-dimensional vector of numbers and a non-singular matrix.

$E[Y] = AE[Z] + \mu = \mu$

$Var[Y] = V = Var[AZ] = E[(AZ)(AZ)^T] = E[AZZ^T A^T]$

$= AE[ZZ]^T A^T = AA^T \ \therefore Y \sim N_P(\mu, V)$

Distribution of $(Y - \mu)^T V^{-1} (Y_p - \mu)$

$(Y - \mu)^T V^{-1} (Y - \mu) = Z^T Z = \sum_{i=1}^{P} Z_i^2 \sim \chi_p^2$ that is χ^2 distribution with p df since $Z_i \sim N(0,1)$ and independent.

3.20 Wald test

As a rule, if $Y \sim N_p(\mu, V)$ *then* $(Y - \mu)' V^{-1} (Y - \mu) \sim \chi_p^2$

$\hat{\beta} \approx N_p(\beta, \mathrm{I}^{-1}(\beta))$ now the Wald test with $\hat{\mathrm{I}} = \mathrm{I}(\hat{\beta})$ On the other hand worked in a consistent estimate of ϕ if required will be $(\hat{\beta} - \beta)^T \hat{\mathrm{I}} (\hat{\beta} - \beta) \approx \chi_p^2$ and then also $(\hat{\beta} - r)^T [C\hat{\mathrm{I}}^{-1} C^T]^{-1} (\hat{\beta} - r) \approx \chi_p^2$ once the test result of statistics is large the hypothesis is

rejected. The MLE $\hat{\beta}$ of the full model is expected, whereas also a reliable estimate of ϕ, if ϕ is undefined.

3.21 Score test

As $S(\beta) \approx N_p(O, \mathrm{I}(\beta))$, Then the score test statistics with $\tilde{\mathrm{I}} = \tilde{\mathrm{I}}(\tilde{\beta})$ still also plugged in a fixed estimate of ϕ when required will be $S(\tilde{\beta})^T \tilde{\mathrm{I}}^{-1} S(\tilde{\beta}) \sim \chi_p^2$. MLE $\tilde{\beta}$ of the limited model is needed and consistent estimate of ϕ if ϕ is unrevealed

3.22 Comparison of test properties

In respect to the Likelihood Ratio test, the Wald test and Score test, they produce different result with the presence of small observation (sample) but asymptotically are the same. However, the Likelihood Ratio test and Score test yield a better small sample properties than the Wald statistics and the Wald test is correspondent to the normal confidence interval CI for β_j, Then the LRT can be analyzed directly from the likelihood with no fishers estimate statistics and it is very simple to use. The application of Score test is suitable to use for one sided test

3.23 Likelihood ratio test

The $\hat{\beta}$ stand for the MLE in the complete unchecked model then $\tilde{\beta}$ MLE in the restricted model where; $C\beta = r$. The likelihood ratio turn into $2\log\left[\frac{L(\hat{\beta})}{L(\hat{\beta})}\right] = 2[l(\hat{\beta}) - l(\tilde{\beta})] \approx \chi_p^2$.

The $\hat{\beta}$ with $\tilde{\beta}$ are needed equally. When ϕ is not recognized, the alike consistent estimate of ϕ in the two likelihoods should be applied.

Deviance and likelihood ratio tests: Linear regression analysis generally deals with partitioning of variance via the sum of square calculations. The variance is divided into variance accounted by

the predictors and residual variance while in logistic regression analysis, contrary is used as a substitute of sum of squares calculations. Deviation is comparable to the sum of squares estimates in linear regression while it measures the lack of fit to the data in a logistic regression model. When there is availability of a saturated model, that is the model that has notional exact acceptability, calculation of deviation is through comparing a given example with the saturated model, the computation becomes the likelihood ratio test. There are two channels of deviation that are essential in logistic regression which are the null deviation and then model deviation. However, the null deviance demonstrates the difference between a model with only intercept which means no predictors and the saturated model while in case of the model deviance demonstrate the difference between a model with at least one predictor and also a saturated model. With regards to this, the null model gives a starting point for comparing predictor models. Assigned that the deviance is the degree of difference among a model and the saturated model, with smaller values indicating a better fit. Hence in other to determine the influence of predictors, the model deviance should be subtracted from the null deviance and estimate the difference on a chi-square distribution with degrees of freedom (df), equivalent to the difference in the figure of estimated parameters. When the model deviance is considerably smaller than the null deviance therefore one can be able to resolve that the set of predictors significantly bettered the fitted model. However, is related to the F-test used in linear regression analysis in evaluating the significance of prediction. Assuming if the saturated model is unavailable, a usual situation for calculating the deviance is simply as -2·(log likelihood of the fitted model), then also citation of the saturated model's log likelihood could be eliminated from all that follows with no harm. likelihood ratio test is normally used for the estimation of model fit, it is then a technique that is endorsed to judge the effort of individual predictors to a given model. For the situation of a single predictor model, one can simply equate the deviation of the predictor model alongside the null model of a chi-square distribution using a one degree of freedom (df). In the case of the predictor model that contains significant smaller deviation cumulative frequency Chi-Square using the difference in degree of freedom of the two models, with regards to that one may conclude that there is significant relationship concerning the predictor and the outcome variable. Logistic regression is very exceptional for estimating unstable data relatively than randomly sampled data, and yet would yield precise coefficient estimates of the effects for every independent variable on the result. Therefore, if logistic model is form from

such data with a correct model in the general population, all the parameters are correct apart from. It can be corrected if the true occurrence in the sample is known.

3.24 Extension of the maximum liklihood

3.24.1 Regularization

The procedure of performing regularization is the same as conducting maximum posterior estimation which is the extension of maximum likelihood. Generally subject regarding regularization circumstances seeking to eliminate doubtful values, particularly very larger number for any coefficients of regression. However, making use of regularization order is corresponding of performing maximum posterior assessment, with addition of maximum likelihood. Regularization generally can be done by using a squared regularizing function which is the same or equal assigning(fixing) a zero mean Gaussian prior to the distribution on coefficients while other regularizes are going to be possible. Whether the regularization is used or not, is not possible workable to attain a closed method of way out rather to use an iterative numerical procedure and these methods could be iteratively reweighted least squares (IRLS) or else, a quasi-Newton method, such as the L-BFGS method which is more commonly used. In Bayesian statistics situation, prior distributions, normally is placed on the regression coefficients, in form of Gaussian distributions. There is no conjugate preceding of the likelihood function in logistic regression. When Bayesian assumption was done systematically, this makes the posterior distribution very difficult to calculate except with a low magnitude.

CHARPTER FOUR

4.0 Arrangement and Analysis of Result

Authentic Statistics Result of Patient Undergoing Follow up from Teaching Hospital Gombe, State Nigeria

Table 4.0 Response of patient follow-up

Response of Patient follow-up			
		Frequency	%
Sex	Male	1647	31.7%
	Female	3349	64.4%
CD4	Yes	269	5.2%
	No	4730	91.0%
Haematology	Yes	224	4.3%
	No	4775	91.8%
Chemistry	Yes	229	4.4%
	No	4770	91.7%
Hospital status	Alive	4797	92.3%
	Death	86	1.7%
	Transfer	117	2.3%
Marital status	Divorced	190	3.7%
	Married	3523	67.8%
	Widow	536	10.3%
	Single	725	13.9%
State	Gombe	3008	57.8%
	Bauchi	315	6.1%
	Yobe	157	3.0%

	Continuation from Table 4.0		
	Borno	102	2.0%
	Adamawa	193	3.7%
	Taraba	71	1.42%
	Others	75	1.5%
Month of last visit	January	251	4.8%
	February	147	2.8%
	March	330	6.3%
	April	216	4.2%
	May	748	14.4%
	June	661	12.7%
	July	895	17.2%
	August	273	5.3%
	September	513	9.9%
	October	464	8.9%
	November	275	5.3%
	December	173	3.3%
Month of next visit	January	492	9.5%
	February	382	7.3%
	March	369	7.1%
	April	257	4.9%
	May	196	3.8%
	June	247	4.8%
	July	264	5.1%
	August	240	4.6%
	September	732	14.1%

	Continuation from Table 4.0		
	October	635	12.2%
	November	880	16.9%
	December	252	4.8%
Occupation	Student	332	6.4%
	Retiree	58	1.1%
	Farmer	141	2.7%
	Banker	12	0.2%
	Civil servant	2017	38.8%
	House wife	557	10.7%
	Private	65	1.3%
	Business	365	7.0%
	Health personnel	38	0.7%
	Military & Paramilitary	112	2.2%
	Hand work	86	1.7%
	Teacher	82	1.6%
	Others	8	0.2%
	Tangale	1493	28.7%
	Cham	47	0.9%
	Bachama	36	0.7%
	Wurkum	21	0.4%
	Fulani	453	8.7%
	Bolewa	56	1.1%
	Tula	120	2.3%
	Tera	172	3.3%
	Pero	70	1.3%

Tribe			
	Continuation from Table 4.0		
	Babur	66	1.3%
	Lungua	43	0.8%
	Yoruba	28	0.5%
	Hausa	263	5.1%
	Karekare	28	0.5%
	Igbo	81	1.6%
	Kanuri	54	1.0%
	Others	295	5.7%
Age category	13 – 22	297	5.7%
	23 – 32	2049	39.4%
	33 – 42	1674	32.2%
	43 – 52	762	14.7%
	53 and above	209	4.0%
Last visit on Quarter system	1st quarter	728	14.0%
	2nd quarter	1625	31.3%
	3rd quarter	1681	32.3%
	4th quarter	912	17.5%
Nest visit on Quarter system	1st quarter	1243	23.9%
	2nd quarter	700	13.5%
	3rd quarter	1236	23.8%
	4th quarter	1767	34.0%

Table 4.0 above describe the characteristics of patient receiving ART from Teaching Hospital Gombe. We have seen that among the patient undergoing follow-up female were greatly higher with 64.4% and male patient were really lower with 31.7%. Those attending follow-up and have

CD4 count accounted less with about 5.2% compared to those without the CD4 count with 91.0%. Patient with Hematology were about 4.3% which is less than those without hematology 91.9%. Result of patient with chemistry was 4.4% while those that don't have chemistry result gave 91.7%. Hospital status for those that were alive receiving treatment recorded 92.3% while those that were death showed 1.76% and those on transfer reveal 2.3% respectively. In respect of marital status, those that were married accounted with the highest number in term of follow-up 67.8% followed by those that were not married that is single with 1.9%, widow with 10.6% and divorcee with the least showed 3.7%. Patient location of follow-up showed that mother state has the majority with 57.8%, followed by Bauchi with 6.1%, Adamawa 3.7%, Yobe 3.0%, Borno 2.0%, Taraba 1.4% and combination from various state with little patient accounted for 1.4%. Month of last visit showed that July experiences the highest tone out of patient that gave 17.2% while February has the list with (2.8%). However contradictory November among the month of next visit has the highest number with 16.9% while month of May has the least with 3.8%. Livelihood of civil servant recorded the highest with follow-up showing 38.8% while bankers 0.2% and combination of other occupation also gave 0.2%. Tribe within and outside the zone reveal that Tangale tribe having 28.7% were more alerted, ready to stop and control the spread of disease while Wurkum tribe with 0.4% with some other combination of tribe need to be more enlighten about the danger and eradication of the virus. Patient with age category of 23 to 32 showed 39.4% with the highest majority number of follow-up, then followed by group 33 to 42 with 32.2%, 43 to 52 gave 14.7 % , 13 to 22 gave 5.7% while also 50 and above showed 4.0%. Visiting on Quarter basis for last visit showed that third quarter experience the largest number of patient visit with 32.3%, followed by 2nd quarter with 31.3%, 4th quarter with 17.5% and the least was first quarter with 14.0%. However patient next quarter of visit showed that fourth quarter experiences the largest number of follow-up with 34.0% subsequently 23.9% in the 1st quarter, 23.8% in the 3rd quarter and 13.5% was seen to be the lowest from 2nd quarter.

Table 4.1: Mann Whitney and One Way Anova of Kruskal Wallis Test

	Variable	N	Med	Min	Max	Z and p-value
Age with gender	Male	1646	38.00	13	75	$Z = -21.804$
	Female	3341	30.00	14	76	$(p < 0.001)$

	$p < \alpha$, there is significant different between age among gender. Age of male receiving Art is not equal to age of female receiving Art					
Age with CD4	Yes	268	34.00	18	65	$Z = -0.075$
	No	4722	34.00	13	76	$(p = 0.940)$
	$p > \alpha$, there is no significant different between age among CD4. Age of those with CD4 is equal to age of those without CD4					
Age with chemistry	Yes	228	34.00	18	56	$Z = -0.125$
	No	4762	34.00	13	76	$(p = 0.901)$
	$p > \alpha$, there is no significant different between age among chemistry. Age of those with chemistry is equal to age of those without Chemistry					
Age with haematology	Yes	223	33.00	18	56	$Z = -0.553$
	No	4767	34.00	13	76	$(p = 0.580)$
	$p > \alpha$, there is no significant different between age among hematology. Age of those with hematology is equal to age of those without hematology					
Age with hospital status	Alive	4789	34.00	13	76	$\chi^2 = 2.920$
	Death	85	32.00	18	56	$(p = 0.087)$
	Transfer	117	35.00	18	65	
	$p > \alpha$, there is no significant difference among hospital status. Hospital status 1=2=3					
Age with marital status	Divorce	190	33.00	20	61	$\chi^2 = 149.019$
	Married	3518	35.00	14	75	$(p < 0.001)$
	Widow	532	33.00	18	76	
	Single	725	30.00	13	61	
	$p < \alpha$, there is significant difference, divorce vs married is 0.166, divorce vs widow is 0.555, divorce vs single is 0.000, married vs widow					

	is 0.234, married vs single is 0.000, widow vs single is 0.000. Mean: Divorce is 34.83, married is 35.47, widow is 35.11, single is 31.02					
Age with state	Gombe	3002	34.00	13	76	$\chi^2 = 10.452$ ($p = 0.107$)
	Bauchi	315	34.00	15	75	
	Yobe	157	35.00	17	64	
	Maiduguri	102	36.00	20	63	
	Adamawa	192	33.00	18	65	
	Taraba	71	31.00	18	52	
	Other	75	33.00	17	60	
	$p > \alpha$, there is no significant different between age among those coming for follow-up from the state. State=1=2=3=4=5=6=7					
Age with last visit	1st Q	726	32.00	17	68	$\chi^2 = 9.273$ ($p < 0.026$)
	2nd Q	1621	33.00	14	70	
	3rd Q	1679	34.00	17	70	
	4th Q	912	34.00	13	76	
	$p < \alpha$, there is significant different between age among last visit. At least one shows different. Mean: 1st Q is 34.06, 2nd Q is 34.65, 3rd Q is 35.29 and 4th Q is 34.65.					
Age with next visit	1st Q	1243	34.00	13	76	$\chi^2 = 9.273$ ($p = 0.128$)
	2nd Q	698	32.00	15	68	
	3rd Q	1233	34.00	14	70	
	4th Q	1764	34.00	17	70	
	$p > \alpha$ there is no significant different between age among next visit. 1st Quarter =2Q=3Q=4Q					

Table 4.1 above for the age with gender showed that $p < \alpha$ indicating a significant different between age among gender revealing age of male patient receiving Art treatment is not equal to age of female patient receiving Art treatment in the hospital. Age with CD4 count displayed that $p > \alpha$ showing there is no significant different between age among CD4 count, this showed that age of those with CD4 is equal to age of those without CD4. The result for age with chemistry showed that $p > \alpha$, showing no significant different between age among chemistry. Age of those with chemistry is equal to age of those without Chemistry. The result of age with haematology showed that $p > \alpha$, revealing no significant different between age among haematology. Age of those with haematology is equal to age of those without haematology. Age with hospital status result showed that $p > \alpha$, showing there is no significant difference between age among hospital status. Hospital status 1=2=3. The result for age with marital status indicate that $p < \alpha$ mean there is significant different between age among marital status. At least one of the marital status showed different. After further analysis, it was seen that patient that were not married has less population in term of visit compare to the remaining status. The result of age with age category showed that $p < \alpha$ showing a significant difference between age among age category. At least one of the age category surfaced different that requires further analysis, age category 53 above showed 57.85% with the highest while age category 13 to 22 has the least with 20.34%. The result of age with various state of patient visit showed that $p > \alpha$ indicating no significant different between age among those coming for follow-up from different state. State 1 is equal to 2, 3, 4, 5, 6 and 7. In respect of Quarter visit, the result for age with month of last quarter of visit showed that $p < \alpha$ revealing there is significant different between age among last quarter of visit. 1st quarter is equal to 2nd, 3rd, 4th quarter. Base on the mean third quarter has the highest record of patient tone out compare to others. There was contrary in respect to next visit of quarter system, which the statistics for age with quarter of next visit gave a $p > \alpha$ showing no significant different between age among next visit. Since p is greater than alpha it requires no further analysis.

Table 4.2: Cross Tabulation (Chi-Square) Study of patient follow-up

Gender versus State								
	Gombe	Bauchi	Yobe	Borno	Adamawa	Taraba	Others	p and χ^2
Male								
Count	981	106	60	42	55	20	24	
% within Sex	76.2%	8.2%	4.7%	3.3%	4.3%	1.6%	1.9%	
% within state	32.6%	33.7%	38.2%	41.2%	28.5%	28.2%	32.0%	$p = 0.254$
Female								$\chi^2 = 7.788$
Count	2024	209	97	60	138	51	51	
% within Sex	77.0%	7.9%	3.7%	2.3%	5.2%	1.9%	1.9%	
% within state	67.4 %	66.3%	61.8%	58.8%	71.5%	71.8%	68.0%	
Gender versus Age group								
	13-22	23-32	33-42	43-52	53 above			
Male								
Count	48	389	701	393	115			
% within Sex	2.9%	23.6%	42.6%	23.9%	7.0%			
% within age G.	16.2%	19.0%	42.0%	51.6%	55.0%			$p < 0.001$
Female								$\chi^2 = 445.060$
Count	249	1659	970	369	94			
% within Sex	7.5%	49.7%	29.0%	11.0%	2.8%			
% within age G.	83.8%	81.0%	58.0%	48.4%	45.0%			
Gender versus Marital status								
	Divorce	Married	Widow	Single				
Male								
Count	2	1361	19	253				

% within Sex	0.1%	83.2%	1.2%	15.5%				$p < 0.001$
% within marital S.	1.1%	38.7%	3.5%	34.9%				
Female								$\chi^2 = 351.020$
Count	188	2158	517	472				
% within Sex	5.6%	64.7%	15.5%	14.2%				
% within marital S.	98.9%	61.3%	96.5%	65.1%				
Gender versus Last visit on quarter basis								
	Q1	Q2	Q3	Q4				
Male								
Count	216	524	568	317				
% within Sex	13.3%	32.2%	35.0%	19.5%				
% within. LQ visit	29.7%	32.3%	33.8%	34.8%				$p = 0.124$
Female								$\chi^2 = 5.760$
Count	511	1100	1112	594				
% within Sex	15.4%	33.2%	33.5%	17.9%				
% within. LQ visit	70.3%	67.7%	66.2%	65.2%				
Gender versus Next visit on quarter basis								
	Q1	Q2	Q3	Q4				
Male								
Count	432	212	416	565				
% within Sex	26.6%	13.0%	25.6%	34.8%				
% within. NQ visit	34.8%	30.3%	33.7%	32.0%				$p = 0.156$
Female								$\chi^2 = 5.222$
Count	809	488	819	1201				
% within Sex	24.4%	14.7%	24.7%	36.2%				

% within NQ visit	65.2%	69.7%	66.3%	68.0%				
Quarter of last visit versus Quarter of next visit								
	Q1	Q2	Q3	Q4				
Q1								
Count	71	439	151	67				
% within last visit	9.8%	60.3%	20.7%	9.2%				
% within next visit	5.7%	62.7%	12.2%	3.8%				
Q2								
Count	57	75	951	542				
% within last visit	3.5%	4.6%	58.5%	33.4				$p < 0.001$
% within next visit	4.6%	10.7%	76.9%	30.7				$\chi^2 = 4634.202$
Q3								
Count	426	45	93	1117				
% within last visit	25.3	2.7	5.5	66.4				
% within next visit	34.3	6.4	7.5	63.2				
Q4								
Count	689	141	41	41				
% within last visit	75.5%	15.5%	4.5%	4.5%				
% within next visit	55.4%	20.1%	3.3%	2.3%				
Gender versus Hospital Status								
	Alive	Death	Transfer					
Male								
Count	1580	27	40					
% within Sex	95.9%	1.6%	2.4%					
% within H. status	33.0%	31.4%	34.2%					

Female								$p = 0.916$
Count	2313	59	77					$\chi^2 = 0.175$
% within Sex	95.9%	1.8%	2.3%					
% within H. status	67.0%	68.6%	65.8%					
Gender versus CD4 count								
	Yes	No						
Male								
Count	82	1565						
% within Sex	5.0%	95.0%						
% within CD4	30.5%	33.1%						$p = 0.372$
Female								$\chi^2 = 0.797$
Count	187	3161						
% within Sex	5.6%	94.4%						
% within CD4	69.5%	66.9%						
Gender versus chemistry								
	Yes	No						
Male								
Count	72	1575						
% within Sex	4.4%	95.6%						
% within Chem.	31.4%	33.0%						
Female								
Count	157	3191						$p = 0.614$
% within Sex	4.7%	95.3%						$\chi^2 = 0.255$
% within Chem.	68.6%	67.0%						
Gender versus hematology								

	Yes	No						
Male								
Count	69	15728						
% within Sex	4.2%	95.8%						
% within Hem.	30.8%	33.1%						
Female								$p = 0.480$
Count	155	3193						$\chi^2 = 0.499$
% within Sex	4.6%	95.4%						
% within Hem.	69.2%	66.9%						

The above result from table 4.2 showed no significant between patient gender and state of patient visit. However, there was significant association between gender and age category. Gender and marital status showed there was no association between them, no significant association between gender with last quarter of visit and gender with next quarter of visit was seen. Follow-up result base on quarter visit showed there was significant relationship between Quarter of last visit with Quarter of next visit. (p-value 0.000). showed also no significant effect between gender with hospital status. Gender with CD4, chemistry and hematology were not significant showing no association between gender with CD4, chemistry and hematology.

Logistic Regression

In this analysis the dependent variable (response variable) is the sex while the predictor variables are the covariates. Representing the explanatory variables which assumed to have influence on the patient receiving ART. The variables used for the prediction were as follows.

- Age
- CD4 (Yes, No)
- Haematology (Yes, No)
- Chemistry (Yes, No)
- Hospital Status (Alive, Death, transfer)
- Marital Status (divorce, married, widow, single)

- Age category (13-22, 23-32, 33-42, 43-52, 53 and above)
- State (Gombe, Bauchi, Yobe, Borno, Adamawa, Taraba, others)
- Last visit base on Quarter (1st Quarter, 2nd Quarter, 3rd Quarter)
- Next visit base on Quarter (1st Quarter, 2nd Quarter, 3rd Quarter)
- Occupation (student, civil servant, house wife, private, business, health personnel, military & paramilitary, hand work, teacher, retiree, farmer, banker, others)
- Month of last visit (Jan, Feb, April, May, July, August, Oct, November)
- Month of next visit (Jan, Feb, April, May, July, August, Oct, November)

Table 4.3 Logistic Regression

Variable	β	P	$Exp(\beta)$	95% CI for $Exp(\beta)$	
				Lower	Upper
Age	-0.082	$p < 0.001$	0.921	0.912	0.931
CD4 (baseline Yes)					
No	-0.057	0.907	0.945	0.363	2.456
Haematology (baseline Yes)					
No	0.283	0.680	1.327	0.346	5.079
Chemistry (baseline Yes)					
No	0.055	0.935	1.057	0.282	3.964
Hospital status (baseline transfer)					
Live	-0.090	0.769	0.914	0.500	1.668
Death	-0.453	0.319	0.636	0.261	1.550
Marital status (baseline single)					
Divorce	4.004	$p < 0.001$	54.798	13.031	230.442

Married	-0.238	0.078	0.788	0.605	1.027
Widow	3.106	$p < 0.001$	22.325	11.789	42.277
Age category (baseline 53 above)					
13-22	2.429	$p < 0.001$	11.351	5.927	21.738
23-32	1.876	$p < 0.001$	6.525	4.157	10.242
33-42	0.759	$p < 0.001$	2.136	1.369	3.331
43-52	0.166	0.485	1.181	0.740	1.884
State (baseline others)					
Gombe	-0.250	0.464	0.799	0.399	1.521
Bauchi	-0.268	0.471	0.765	0.369	1.585
Yobe	-0.375	0.354	0.687	0.311	1.519
Maiduguri	-0.620	0.163	0.538	0.225	1.285
Adamawa	-0.218	0.583	0.804	0.369	1.750
Taraba	-0.119	0.808	0.888	0.341	2.315
Quarter month of last visit (baseline Q4)					
1st Quarter	-0.593	0.096	0.552	0.275	1.112
2nd Quarter	-0.355	0.328	0.701	0.344	1.427
3rd Quarter	-0.555	0.133	0.574	0.279	1.183
Quarter month of next visit (baseline Q4)					
1st Quarter	0.207	0.524	1.230	0.650	2.329
2nd Quarter	-0.116	0.734	0.891	0.456	1.738
3rd Quarter	-0.221	0.458	0.802	0.447	1.438

Occupation (baseline others 13)					
Student	0.236	0.781	1.266	0.240	6.690
Civil servant	0.572	0.493	1.771	0.345	9.086
House wife	2.433	$p < 0.004$	11.389	2.155	60.182
Private	0.824	0.368	2.281	0.379	13.708
Business	0.362	0.668	1.437	0.274	7.531
Health personnel	0.634	0.497	1.886	0.302	11.772
Military and para military	0.310	0.720	1.363	0.250	7.432
Hand work	-0.496	0.571	0.609	0.110	3.384
Teacher	0.970	0.274	2.637	0.464	14.991
Retiree	1.239	0.173	3.452	0.580	20.545
Farmer	-0.868	0.318	0.420	0.076	2.304
Banker	-0.565	0.612	0.568	0.064	5.057
Month of last visit (baseline December)					
January	0.255	0.415	1.291	0.699	2.385
February	0.122	0.703	1.130	0.603	2.117
April	-0.245	0.400	0.783	0.442	1.385
May	-0.228	0.332	0.796	0.502	1.262
July	-0.413	0.152	0.662	0.376	1.164
August	-0.180	0.539	0.836	0.471	1.481
October	-1.021	$p < 0.007$	0.360	0.172	0.754
November	-0.856	$p < 0.024$	0.425	0.202	0.895
Month of next visit (baseline December)					
January	-0.393	0.210	0.675	0.366	1.247

February	-0.019	0.952	0.981	0.530	1.817
April	0.047	0.887	1.048	0.546	2.014
May	-0.288	0.392	0.750	0.388	1.451
July	-0.124	0.661	0.883	0.507	1.539
August	0.029	0.908	1.030	0.627	1.691
October	-0.256	0.385	0.774	0.435	1.378
November	0.091	0.756	1.096	0.616	1.949

Table 4.3 result: Age was seen to be having a significant power on the patient receiving ART $p < \alpha\ (OR: 0.921,\ 95\%\ CI: 0.912 - 0.931)$. The OR value for CD4 is 0.945 showing the risk of HIV patient with no CD4 count is lower with about 5.5% relating to those with CD4. Similarly, haematology OR value is 1.327 showing the risk of patient without haematology checkup is higher with 1.337 times compared to those with haematology result. Those patient with no chemistry is 1.057 showing higher risk of 1.060 times compared to patient with chemistry. The OR value for patient status receiving treatment in the hospital was not significant showing alive is 0.914 and death is 0.636, indicating there was lower risk in alive patient with about 8.6% compared to death patient with 36.4%. Marital status showed that divorce and widow were significant $p < \alpha$ $(OR: 54.798,\ 95\%\ CI: 13.031 - 230.442)$, $(OR: 22.325,\ 95\%\ CI: 11.789 - 42.277)$. This showed that divorce patients were having higher times victim comparing to widow, while married was not significant revealing 21.2% less risk of patient within the status. Age category showed significant in age group 13 to 22 $p < \alpha\ (OR: 11.351,\ 95\%\ CI: 5.927 - 21.738)$ similarly 23 to 32 $p < \alpha$ $(OR: 6.525,\ 95\%\ CI: 4.157 - 10.242)$, 33 to 42 $p < \alpha\ (OR: 2.136,\ 95\%\ CI: 1.369 - 3.331)$ but age group 43 to 52 those not attained statistical significant $p > \alpha$ $(OR: 1.181,\ 95\%\ CI: 0.740 - 1.884)$. For these ages groups 13-22 showed the highest with patient receiving ART while the 43-52 age group was having the least patient. Place of visit for all the various state was not significant, showing there was lower risk of patient receiving ART from all the state, which were as follows; 11.8% from Taraba also 19.6% from Adamawa, 20.1% from Gombe, 23.5% from Bauchi, 31.3% from Yobe and about 46.2% from Borno. Taraba state in terms

of visit have the least while Borno is topping with the highest follow-up. Last month of visit in respect of quarter basis showed not significant in all, were the OR value gave 44.8% for 1st Quarter, 29.9% for 2nd Quarter and 42.6% for 3rd Quarter. This reveal that 2nd quarter experiences low response compared to 1st quarter and 3rd quarter. However, the quarter basis for next month of visit also was not significant in all showing 1.230 times higher in 1st quarter while low response of 10.9% was seen in 2nd quarter compared to 19.8% in 3rd quarter. Occupation with reference others showed that student OR value was 1.266 times higher, civil servant accounted to 1.771 times higher, house wife was significant $p < \alpha$ $(OR: 11.389,\ 95\%\ CI: 2.155 - 60.182)$, OR for private reveal 2.281 times higher, business was 1.437 times higher, health personnel showed 1.886 times higher, military and paramilitary accounted with 1.363 times higher, hand work was 39.1% with lower risk, teacher recorded 2.637 times higher, retiree showed 3.452 time higher, farmer with 58% lower risk and banker was 43.2% of lower risk. Patient month of last visit with reference December showed that month of October and November were statistically significant $p < \alpha$ $(OR: 0.360,\ 95\%\ CI: 0.172 - 0.752), (OR: 0.425,\ 95\%\ CI: 0.202 - 0.895)$, however the remaining month were not significant and their odd ratios will be seen as follows; OR for month of January is (1.291) times higher, February is (1.130) times higher, April is 21.7% lower , May is 20.4% lower , July is 33.8% lower and August is 16.4% lower. Contrary Next month of patient visit for all the month was not significant which reveal that January 32.5% lower, February 1.9% lower, April 1.048 times higher, May 25% lower, July 11.7% lower, August 1.030 times higher, October 22.6% lower and November (1.096) times higher.

Multinomial Logistic

Multinomial Logistic Regression with Interaction using dependent variable box and factors box, leaving the covariate box empty, after then the model was click and custom step wise was selected, from the build terms, again interaction was selected and categorical variable was send in the forced entry term box, continue and ok was click.

Table 4.4 Multinomial Logistic Regression

				95% CI for $Exp(\beta)$	
Variable	β	P	$Exp(\beta)$	Lower	Upper
Age category (13-23 ref 53+) and marital status (ref single)					
Divorce	-2.652	$p < 0.001$	0.071	0.024	0.210
Married	-2.609	$p < 0.001$	0.074	0.035	0.156
Widow	-2.482	$p < 0.001$	0.084	0.033	0.209
Age category (23-32 ref 53+) and marital status (ref single)					
Divorce	-1.839	$p < 0.001$	0.159	0.063	0.401
Married	-1.647	$p < 0.001$	0.193	0.094	0.395
Widow	-1.453	$p < 0.001$	0.234	0.103	0.532
Age category (33-42 ref 53+) and marital status (ref single)					
Divorce	-1.658	$p < 0.001$	0.190	0.074	0.489
Married	-1.168	$p < 0.002$	0.311	0.150	0.642
Widow	-1.247	$p < 0.003$	0.287	0.125	0.660
Age category (43-52 ref 53+) and marital status (ref single)					
Divorce	-1.307	$p < 0.010$ 0.010	0.271	0.100	0.733
Married	-0.902	$p < 0.019$	0.406	0.191	0.861
Widow	-0.813	0.065	0.444	0.187	1.053
Age category (13-22 ref 53 and above) hospital Status (ref transfer)					
Alive	0.652	0.234	1.919	0.656	5.617
Death	0.981	0.270	2.667	0.466	15.252
Age category (23-32 ref 53 and above) hospital Status (ref transfer)					

Alive	0.568	0.146	1.765	0.821	3.798
Death	0.812	0.254	2.252	0.558	9.090
Age category (33-42 ref 53 and above) hospital Status (ref transfer)					
Alive	0.620	0.120	1.859	0.850	4.063
Death	0.793	0.272	2.210	0.537	9.098
Age category (43-52 ref 53 and above) hospital Status (ref transfer)					
Alive	0.249	0.552	1.282	0.565	2.911
Death	0.043	0.957	1.043	0.225	4.840
State of visit (Gombe: ref other) and hospital status (ref transfer)					
Alive	-0.573	0.572	0.564	0.077	4.114
Death	1.688	0.136	0.185	0.020	1.702
State of visit (Bauchi: ref other) and hospital status (ref transfer)					
Alive	-0.618	0.563	0.539	0.066	4.382
Death	-1.856	0.139	0.156	0.013	1.828
State of visit (Yobe: ref other) and hospital status (ref transfer)					
Alive	-0.330	0.777	0.719	0.073	7.036
Death	-1.386	0.317	0.250	0.017	3.770
State of visit (Maiduguri: ref other) and hospital status (ref transfer)					
Alive	-1.707	0.343	0.343	0.038	3.134
Death	-2.079	0.141	0.125	0.008	1.998
State of visit (Adamawa: ref other) and hospital status (ref transfer)					
Alive	-0.643	0.560	0.526	0.060	4.580
Death	-1.609	0.217	0.200	0.016	2.575
State of visit (Taraba: ref other) and hospital status (ref transfer)					

Alive	-0.708	0.567	0.493	0.044	5.561
Death	-20.914	$p < 0.001$	8.265E-10	8.265E-10	8.265E-10
Gender (ref female) and State of visit (ref: others)					
Gombe	0.030	0.906	1.030	0.630	1.683
Bauchi	0.075	0.785	1.078	0.629	1.847
Yobe	0.273	0.357	1.314	0.734	2.353
Maiduguri	0.397	0.213	1.488	0.796	2.780
Adamawa	-0.166	0.573	0.847	0.476	1.508
Taraba	-0.182	0.614	0.833	0.410	1.693
1st Quarter of last visit (ref third quarter) and State of visit (ref: others)					
Gombe	0.035	0.932	1.036	0.465	2.304
Bauchi	0.241	0.594	1.273	0.524	3.091
Yobe	0.047	0.921	1.048	0.412	2.669
Maiduguri	0.142	0.787	0.868	0.311	2.423
Adamawa	0.003	0.995	1.003	0.391	2.573
Taraba	0.328	0.572	1.388	0.445	4.329
2nd Quarter of last visit (ref third quarter) and State of visit (ref: others)					
Gombe	0.450	0.224	1.568	0.759	3.236
Bauchi	0.753	0.063	2.122	0.960	4.694
Yobe	0.124	0.773	1.132	0.486	2.637
Maiduguri	0.209	0.649	1.233	0.500	3.038
Adamawa	0.464	0.275	1.591	0.691	3.662

Taraba	0.727	0.157	0.068	0.757	5.654
3rd Quarter of last visit (ref third quarter) and State of visit (ref: others)					
Gombe	-0.225	0.486	0.798	0.424	1.505
Bauchi	-0.054	0.883	0.948	0.464	1.935
Yobe	-0.472	0.225	0.624	0.291	1.337
Maiduguri	-0.422	0.315	0.656	0.288	1.494
Adamawa	-0.063	0.868	0.938	0.444	1.983
Taraba	-0.260	0.598	0.771	0.294	2.026
1st Quarter of Next visit (ref third quarter) and State of visit (ref: others)					
Gombe	-0.005	0.986	0.995	0.549	1.802
Bauchi	-0.416	0.219	0.659	0.339	1.281
Yobe	-0.022	0.952	0.978	0.483	1.983
Maiduguri	-0.320	0.414	1.377	0.639	2.965
Adamawa	-0.205	0.564	0.815	0.406	1.635
Taraba	-0.111	0.796	0.895	0.385	2.081
2st Quarter of Next visit (ref third quarter) and State of visit (ref: others)					
Gombe	-0.156	0.649	0.856	0.437	1.674
Bauchi	-0.247	0.514	0.781	0.372	1.640
Yobe	-0.384	0.366	0.681	0.296	1.565
Maiduguri	-0.170	0.718	0.844	0.335	2.125

Adamawa	-0.591	0.161	0.554	0.243	1.264
Taraba	-0.262	0.600	0.769	0.288	2.054
3st Quarter of Next visit (ref third quarter) and State of visit (ref: others)					
Gombe	0.211	0.518	1.234	0.652	2.337
Bauchi	0.178	0.612	1.195	0.600	2.382
Yobe	-0.027	0.945	0.974	0.455	2.082
Maiduguri	0.380	0.361	1.462	0.647	3.308
Adamawa	0.259	0.481	1.296	0.630	2.667
Taraba	0.000	1.000	1.000	0.410	2.441

Form the above table 4.5 in respect to age category with ref 53 and above. Age group 13 to 23 proved statistically significant with lower odd ratio in all the three-marital status, divorce is 92.9% $(OR = 0.071,\ 95\%\ CI = 0.024 - 0.210)$, married is 92.6% $(OR = 0.074,\ 95\%\ CI = 0.035 - 0.156)$ and widow is 91.6% $(OR = 0.084,\ 95\%\ CI = 0.033 - 0.209)$. Marital status for divorce and married has the highest number of patient with the virus in this age category compared to widow. Similarly age group 23 to 32 shows that all the p-values for the marital status were statistically significant , divorce showed 84.1% $(OR = 0.159,\ 95\%\ CI = 0.063 - 0.401)$, married was having 80.7% $(OR = 0.193,\ 95\%\ CI = 0.094 - 0.395)$ and widow was 76.6% $(OR = 0.234,\ 95\%\ CI = 0.103 - 0.523)$, this showed that marital status for divorce and married were higher with the virus in this age category compared to widow. Age group 33 to 42 for the marital status were also statistically significant in all., divorce gave $(OR = 0.190,\ 95\%\ CI = 0.074 - 0.489)$, married is $(OR = 0.311,\ 95\%\ CI = 0.150 - 0.642)$ and widow is $(OR = 0.287,\ 95\%\ CI = 0.125 - 0.660)$. Here marital status for divorce and widow were leading in this age category compared to married. lastly the age category group for 43 to 52 shows that only two of the marital status were significant, divorce reveal $(p = 0.010, OR = 0.271,\ 95\%\ CI = 0.100 - 0.733)$ and married is $(p = 0.019, OR = 0.406,\ 95\%\ CI = 0.191 - 0.861)$ while widow was not statistically significant

showing $(p = 0.065, OR = 0.444,\ 95\%\ CI = 0.187 - 1.053)$. In this marital status divorce and married were higher with the virus in this age category compared to widow. Hospital status (Alive: reference transfer) and age category (reference 53 and above). Hospital status for age bracket 13 to 22 was not significant, death was 2.667 times higher than alive 1.919. However, hospital status for age bracket 23 to 32 was not significant, death was 2.252 times higher than alive 1.765. Hospital status for age bracket 33 to 42 was not significant, death was 2.210 times higher than alive 1.859 and hospital status for age bracket 43 to 52 was not significant, alive was 1.282 times higher than death 1.043. State of visit (Gombe: reference other) and hospital status (reference transfer). Patient state of visit from Gombe shows that the hospital status was not significant showing that alive was lower with about 43.6% and death was lower with about 81.5%. Also, Patient state of visit from Bauchi shows that the hospital status was not significant showing alive was 46.1% lower and death was 84.4% lower. Yobe hospital status showed not significant, alive odd of 28.1% lower and death odd was 75% lower. Patient state of visitors from Maiduguri showed that the hospital status was not significant showing alive odd gave 65.7% lower and death odd was 87.5% lower. Patient state of visit from Adamawa shows that the hospital status was not significant showing alive odd was 47.4% lower and death odd was 80% lower. Patient state of visit from Taraba shows that death status was statistically significant $p < \alpha$. $(p = 0.000, OR = 8.265E-10,\ 95\%\ CI = 8.265E-10 - 8.265E-10)$, but alive patient was not significant showing lower risk of 50.8%. Gender (reference female) and state of visit (reference others). In respect of gender with patient place of visit reveal that all the states were not significant. Maiduguri, Yobe and Bauchi were times higher compare to Gombe, (1.488, 1.314, 1.078, 1.030), while Adamawa with 15.3% is having less patient visit compared to Taraba with 16.7%.

Multinomial logistic regression for examining 1 to 1 matched case control; those not work with goodness of fit statistics since the dependent variable deals with only one value. However, the analysis remove the selection to include intercept in the model by using only the dependent variable and covariate box. The covariate box may take categorical and continuous data. Sex was send in to the dependent variable box while other became the response variable in the covariate box.

Table 4.5 Multinomial Logistic Regression for 1 to 1 matched case control

				95% CI for $Exp(\beta)$	
Variable	β	P	$Exp(\beta)$	Lower	Upper
Hospital No.	0.000	$p < 0.020$	1.000	1.000	1.000
Age	0.070	$p < 0.001$	1.073	1.039	1.109
M of last visit	-0.103	0.072	0.902	0.807	1.009
M of next visit	-0.091	0.113	0.913	0.816	1.022
Marital status	0.009	0.880	1.009	0.897	1.136
Hospital status	0.039	0.770	1.040	0.801	1.351
Occupation	0.080	$p < 0.001$	1.083	1.047	1.121
CD4 count	0.301	0.490	1.351	0.575	3.173
Haematology	0.474	0.457	1.606	0.460	5.605
Chemistry	-0.531	0.396	0.588	0.173	2.002
Address	0.004	0.910	1.004	0.937	1.076
Tribe	-0.006	0.535	0.994	0.977	1.012
Age category	0.013	0.936	1.013	0.736	1.394
Last visit 2	0.282	0.089	1.326	0.958	1.836
Next visit 2	0.260	0.139	1.297	0.919	1.828

Table 4.5: Total number of patient receiving ART form the hospital was seen to be statistically significant $p < \alpha$ $(OR: 1.000, 95\% CI: 1.000 - 1.000)$, there was also statistical significant that reveal by age $p < \alpha$ $(OR: 1.073, 95\% CI: 1.039 - 1.109)$. Month of last visit and month of next visit reduces the odd by 9.8% and 8.7%. Marital status increase the odd by 1.009, hospital status increase the odd by 1.040, however occupation significantly increases the odd by 1.083, CD4 count increase the odd by 1.351, haematology increase the odd by 1.606, more so the results for chemistry

showed no significant with decreased of odd by 41.2%, state of visit increase the odd by 1.004, patient tribe was not significant showing lower risk of 0.6%, age category increase the odd by 1.013. with regards to follow-up based on quarter system for the last patient visit increase the odd by 1.326 and lastly follow-up based on quarter system for next visit increase the odd by 1.297.

CHARPTER FIVE

5.0 SUMMING UP, CONCLUSION AND RECOMMENDATION

5.1 Summary

Statistics from descriptive end result was seen that among the patient undergoing follow-up, within and outside the zone females were having higher number of patient turnout compared to male patient. Those attending follow-up with update CD4 count, Haematology, Chemistry were less compared to those without them. Patient death on the course of the virus while receiving treatment showed ART played an important role for reducing the disease. It was exposed from the marital status that those that were married records with the high peak numbers of follow-up. Patient location of follow-up showed that mother state has the majority with follow-up while Taraba combined with various little state were accounted with less outcomes. Month of last visit showed that July experiences the highest turnout of patient while February experiences the minimum. However next month of visit showed November has experiences the highest number while month of May has the fewest. Occupation of civil servant recorded with highest regarding to follow-up while bankers with combination of others were having smaller number of patient. Tribe within and outside the area showed that Tangale tribe was the leading tribe in terms of follow-up while Wurkum tribe with some other combination of tribe were the least. Patient with age category from 23 to 32 paraded with the highest popular figure of follow-up while 50 and above were the least. Follow-up on Quarter basis showed that third quarter experience the largest number of patient visit while the least was first quarter. However patient next quarter of visit showed that fourth quarter experiences the largest number of follow-up then the lowest was from 2^{nd} quarter. Independent Sample t Test of Mann Whitney result discovered there were significant change occurred between age in the company of gender revealing age of male patient receiving Art treatment is not equal to age of female patient receiving Art treatment in the hospital however age of patient with CD4 count was insignificant specifying there was no difference between age with CD4 count. The result for age with chemistry showed no significant difference between age among chemistry. Age for those with chemistry is equal to age of those without Chemistry. The result of age with haematology reveal no significant difference between age among haematology.

Age with marital status from Kruskal Wallis result showed no significant difference between age among hospital status, hospital status 1 is equal 2 and equal 3. Again, the result for age with marital status point out that there was significant different between age among marital status, which reveal at least one of the marital status confirmed different. The result of age patient with age category showed that there was significant difference between age among age category though at least one of the age category proven different. The result of age with state of visit showed no significant difference between the patient follow-up. In respect of Quarter visit, the result for age with month of last quarter of visit showed there was a significant different between age among last quarter of visit. In contrary for next visit of quarter system, the statistics for age with quarter of next visit showed no significant different between age among next visit which requires no further analysis. From cross tabulation result, it presented a non-significant relationship between patient gender and state of patient visit. However, it showed there was significant association between gender and age category. Gender and marital status showed there was no association between them. Follow-up result base on quarter visit showed there was significant relationship between Quarter of last visit with Quarter of next visit. (p-value 0.000). Displayed also no significant link between gender and hospital status. Gender with CD4, chemistry and haematology were not significant showing no association between gender with CD4, chemistry and haematology. Binary logistic regression findings showed that age was having significant power on the patient receiving ART. The odds value for CD4 count showed lower risk of patient with no CD4 count compared to those with the CD4 count. However, the risk of patient without haematology checkup is higher with 1.337 times compared to those with haematology results. Patient with no chemistry showed higher risk of 1.060 times compared to patient with chemistry. Patient status receiving treatment in the hospital was not significant showing there was lower risk of virus in alive patient compared to death patient. Marital status showed that divorce and widow were significant, disclosing that divorce patient were having higher times victim with virus comparing to widow, while married couples was not significant revealing less risk of patient within the status. Age group 13-22 reveal with the highest patient receiving ART while 43-52 age group was having the least patient. Place of visit for all the state was not significant showing Taraba state in terms of visit was the least while Borno is topping with the highest follow-up. Last month of visit in respect of quarter basis showed not significant in all, revealing that 2nd quarter experiences low response compared to 1st quarter and 3rd quarter. However, the quarter basis for next month of visit also was not significant in all showing 1.230

times higher in 1st quarter while low response was seen in 2nd quarter compared to 3rd quarter. Patient month of last visit with reference December showed that month of October and November were statistically significant but the remaining month were insignificant. Contrary Next month of patient visit for all the month was not significant. Multinomial logistic regression way out regarding to age category with ref 53 and above. Age group 13 to 23 prove statistically significant with lower odd ratio in all the three-marital status. Marital status for divorce and married has the highest number of patient with the virus in this age category compared to widow. Similarly, age group 23 to 32 shows that all the p-values for the marital status were statistically significant, this showed that marital status for divorce and married were higher with the virus in this age category compared to widow. Age group 33 to 42 for the marital status were also statistically significant in all, here marital status for divorce and widow were leading in this age category compared to married. lastly the age category group for 43 to 52 shows that only two of the marital status were significant, divorce and married while widow was not statiscally significant, in this marital status divorce and married were higher with the virus in this age category compared to widow. Patient state of visit from Gombe shows that the hospital status was not significant showing that alive patients were having lower risk of exposure with regards to their drugs compliance compared to what has been seen from death patient as a result of negligence of taking drugs. Patient state of visit from Taraba shows that death was significant higher but those that were alive showed insignificant lower risk of exposure. Gender (reference female) and state of visit (reference others). Considering to patient place of visit it reveal that all the states were not significant. Maiduguri, Yobe and Bauchi were times higher compare to Gombe, while Adamawa was having less patient visit compared to Taraba. For the Multinomial logistic regression examining for one to one matched case control that was done without including the selection of intercept in the model, showed that the total number of patient and age receiving ART form the hospital was seen to be statistically significant. However, there was significantly increases in patient occupation.

5.2 Conclusion

The study supported this research by tackling some challenges and improvement towards people living with HIV/AIDS especially their follow-up. It was realized that there was enough evidence to provide a solution and a way forward for people leaving with HIV/AID, however some

step on how to overcome the spreading of HIV epidemic, compliance to regular follow-up, culture of taking drugs regularly on a fixed time was seen. The result as was ascertained on the enormous female turnout is a signal that reveal how women were devoted with regards to submission to treatment for the HIV/AIDS during follow-up. Male patient need to act in accordance with the female patient, only with their full compliance will assist in reducing and bringing to an end the fight against the epidemic, without the aforementioned it will create an avenue for a setback in combatting the reduction and bringing to an end of the virus, credit to the female. As it was observed some tribe and places especially those coming from rural areas should developed the courage and tradition of knowing their status so that they can be placed on drugs and commence follow-up, this tribe and region should stop the negative comprehension of believe about the virus because the virus is real. Base on the collected fact there was problem of update for patient check-up from the laboratory and update of patient record form the data base. Required laboratory result with record update for the patient during follow-up must be taking serious. More so the analysis result showed that tender age was having the highest contamination with the virus as a result of ignorant about HIV to use condom, poverty and high climax of sex emotion. Married teams were seen to be more shocking with highest number of patient with the virus from all age group this may resulted from lack of sincerity from the men as it was seen from the turnout. Lastly base on the success it was seen that the course of death due to HIV was reduced compared to the previous years, this shows that the ART follow-up plays a part very well in achieving this progress. The hospital Staffs, Management, State and Federal Government, Non-Governmental Body and so on played a vital role indeed. This effort should tackled be young reduction, it should be affected towards preventing feature coming generation with contamination of the virus in the Federal Teaching Hospital, the state and Nigeria in general.

5.3 Recommendations

Base on the results of findings, first to the patient in general I recommend both the gender should be committed in reducing and bringing to an end of the matter not only females as it was seen from the attendance (follow-up). Discussing on the aspect of test (for instance CD4, Chemistry and haematology), patient therefore must be serious with regular update for their laboratory examination also both the gender undergoing follow-up should take their drugs

regularly at accurate time. However, patient leaving with the virus should shorn all sort of stigmatization form the society because is a common phenomenon that should be expected from the general public, they should warm up for such. To the management staffs, nurses, doctors and other personnel I urge them to be continued being more tolerant and understanding with their patient, more so their patient secrete should be highly maintained. To the government Non-Governmental organization, community, religion leaders and so on. The government should provide a different means of circulating accurate knowledge about HIV/AIDS by using school administration in the society. Government should make used of Ministry of Education in Nigeria to include about terrible syndrome like HIV/AIDS in to the curriculum system of education as well as prevention since nobody can go through school without passing through the plat form of a teacher, this will make schools to be greatly change the attitudes and believe of people toward leaving with diseases especially HIV/AIDS. leaders in the community should use their position by providing suitable tactics to be used in the local community, because the community leaders play an important role in any set of community. Conversely Spiritual religion heads in society most not left behind because of respect and recognition they have in the community, with their effort, contribution and support they will help in overpowering a lot concerning about the virus. To address these teachers in schools need to be included in any policy formulation of health education especially those concerning challenges and mistaken belief about the virus. More so they should support any massive campaign awareness about safe sex and regular checkup, for reducing the spread of the virus.

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