FACTORS ASSOCIATED WITH DELAY IN STARTING ANTI-RETROVIRAL TREATMENT AMONG CONFIRMED HIV POSITIVE INDIVIDUALS IN STATE HEALTH FACILITIES IN NORTHERN NAMIBIA

A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS
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ABSTRACT

The purpose of this study was to investigate the factors associated with the delay in starting anti-retroviral treatment (ART) among confirmed HIV-positive individuals in Northern Namibia, specifically the four (4) districts of the UTAP region (Andara, Nyangana, Oshikuku and Tsumeb). The study employed the time series analytical (quantitative) research design that used secondary data retrieved from the Electronic Patient Management System (ePMS) database. The characteristics of data obtained from the ePMS included the Who-stage, age, gender, facility type, CD4 count and District. The study's population was 1824, and the sample size was 1824, as total population sampling was used in this desktop analysis. Descriptive statistics were used to help explore more on objectives one and two of the study. The multivariate (LOGIT) regression model was used to ascertain factors behind the delay in starting the ART among confirmed HIV+ individuals. The study's results indicated that most confirmed HIV+ individuals opted for an early ART start, whereby the age, facility, gender, CD4+ counts were statistically significant. The highest rate of confirmed HIV+ patients starting ART on the same day was in March 2018 (86.3%), followed by June 2018 (80.3%) and February 2018 (80.3%).

The study recommended that treatment literacy for service providers and health care workers on the importance of starting treatment early, enhanced counselling, support for men by male champions, easy of access to ART as essential to ensure confirmed HIV+ people to access the ART in time from day of diagnosis up to day seven. Also, the cost-effectiveness of ART related services, such as decentaralization and equipping of facililities equitably as relevant in reducing the delay in starting ART initiation.

Key words: ART, HIV+, ePMS, Who-stage, age, gender, CD4, Viral load suppression

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LIST OF ABBREVIATIONS & ACRONYMS

AIDS	Acquired Immunodeficiency Syndrome
ANC	Antenatal Care
ART	Antiretroviral Therapy
ARV	Antiretroviral Drugs
CD4+	Cluster of Differentiation 4
ePMS	Electronic Patient Management System (FileMaker Data System)
H_A	Alternative Hypothesis
H_0	Null Hypothesis
HIV	Human Immunodeficiency Virus
HIV+	HIV positive
HTPN 052	The HIV Prevention Trials Network
HWs	Health Workers
MSM	Men-who- have-sex-with-men
MHSS	Ministry of Health and Social Services
NIMART	Nurse-Initiated Management of ART
PLHIV	People Living with HIV
PEPFAR	President's Emergency Plan for AIDS Relief
TB	Tuberculosis
UNAIDS	Joint United Nations Program on HIV/AIDS
USAID	United States Agency for International Development
UTAP	United States Agency for International Development HIV Clinical Services Technical Assistance Project
WHO	World Health Organization
VL	Viral Load

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DEDICATION

I dedicate this study to my children **Dr L.A. Hlahla and D.J. Hlahla.**

Learning does not end.

DECLARATION BY STUDENT

I, Elsie Tingadini Hlahla, hereby declare that the above stated study on "Factors Associated with Delay in starting Anti-Retroviral Treatment among Confirmed HIV Positive Individuals in State Health Facilities in Northern Namibia'', is my own work and is a true reflection of my research, and that this work or any part thereof has not been submitted for a degree at any other institution.

April 2024

STUDENT SIGNATURE DATE

CHAPTER ONE

INTRODUCTION AND BACKGROUND OF THE STUDY

1.1 Introduction

This study investigated the 'Factors Associated with Delay in starting Anti-Retroviral Treatment (ART)[1] among Confirmed HIV Positive Individuals in the State Facilities in four districts in Northern Namibia.' ART is a combination of drugs that work to inhibit the replication of the viral DNA from using the human host cell DNA. The HIV treatment consist of two drugs from the nucleoside/nucleotide reverse transcriptase inhibitors class of drugs, combined with either one integrase inhibitor, one non-nucleoside reverse transcriptase inhibitor, or one protease inhibitor – hence the name triple therapy. ART remains a treatment and not a cure for HIV infection, as the inhibition action of the medicines is known to slow down and suppress the multiplication of the viruses, the process that keeps the body's immune system strong and able to ward off opportunistic infections and functioning fully. ART is therefore a lifetime treatment that requires taking the tablets everyday as prescribed by the clinician.

Up until 2016 the Namibia ART guidelines for starting treatment stipulated that pregnant and breastfeeding women, children and persons with Cluster of Differentiation 4 (CD4+)[8] cell counts measuring below 500 cells/µL or in the presence AIDS-defining illnesses as evidenced by their WHO clinical staging, could start taking treatment as soon as they tested positive for HIV, whilst the rest of the population who tested HIV positive, had treatment deferred whilst their immune system was monitored for weakening by continuous measurement of the CD4+ counts. The higher the CD4+ count was equated as having a strong immune system and the ability to fight off opportunistic infections as persons with a normal immune function can have anywhere

from 500 to 1,500 cells/mL, while persons with a compromised immune system will have less than 200 cell/mL.

The reasons for deferring treatment were wide-ranging, from the fact that people were still feeling well and able to go to work and were productive, the strong belief that people feeling well may not feel the need to start on a lifelong treatment and when started, would not adhere to the treatment and the emergence of resistant strains to the drugs and with onwards passing of the resistant strains. Financially there were budgetary constraints too, with the high costs of procuring the drugs prevailing and a chronic shortage of trained staff, especially amongst the low resourced countries.

In 2016, the updated ART guidelines from the World Health Organization endorsed starting ART for all HIV-infected patients immediately the diagnosis was confirmed, irrespective of the CD4+ count, location, income, or the WHO staging of the disease. The rapid initiation of treatment on confirmation of diagnosis study evidence[9] showed that expanding treatment for HIV+ people results in better health and fewer HIV infections passed onwards, now termed treatment as prevention.

The Ministry of Health and Social Services (MoHSS)[9] made a significant change in the Namibia National Guidelines for ART's 5th Edition of 2016 by adopting the WHO recommendation of ART that stipulated that, all adults from 19 years of age, breast feeding women, adolescents and children, once confirmed HIV+ and regardless of their CD4+ cell counts and World Health Organization (WHO) clinical staging, as eligible to start ART under the Treat All strategy, on the same day or at least within the next 7 days after the HIV positive diagnosis was made. The period up to 7 days would allow time for people to get counselling and to get ready to start on the lifelong treatment. Stating ART from day 8 onwards was regarded as late.

The USAID HIV Clinical Services Technical Assistance Project (UTAP) was providing HIV Prevention, Care and Treatment services to eight (8) high HIV burdened districts' state facilities in Northern Namibia and the data for four districts namely, Nyangana, Andara, Tsumeb and Oshikuku was used for this study, retrospectively.

1.2 Background of the Study

In the year 2018, the United States Agency for International Development (USAID)[2] reported in its President's Emergency Plan for AIDS Relief (PEPFAR) for the Financial Year 2017 at the Country Operational Plan meeting for Namibia, that despite adaptation by the MoHSS of the 'Treat All Strategy' in 2016,[3,4] that gave guidance that people diagnosed with HIV infection start treatment on the same day after receiving the positive result or within the next seven days, as 'not been achieved'.

Namibia has both high HIV prevalence & incidence, generalised mature HIV epidemic and an HIV Antenatal Care (ANC) national prevalence of 17.2% and the national general population prevalence at 11.6%.[5,76] Milestones have been achieved in testing and treatment programs and endeavours to scale up services towards reducing further transmission and the burden of the disease. In a bid to achieve the UNAIDS 90-90-90 targets, a benchmark to reaching HIV epidemic control by the year 2030 was set.[6]

The rapid initiation of treatment on diagnosis study evidence [9] had shown that expanding treatment for HIV+ people results in better health and fewer HIV infections passed onwards, now termed treatment as prevention. Over the years, the protagonists to The HIV Prevention Trials Network (HPTN 052)[10] have confirmed that higher Viral Loads (VL)[11] show a relationship with higher rates of both sexual and mother-to-child HIV transmission and that as the number of virally suppressed people in the

community rises the number of new HIV infections falls. This large study of HIV discordant couples called the HPTN 052 established that; starting and sustaining treatment for HIV infection early, whilst the immune system is relatively healthy, effectively reduced transmission of the virus. Within three to six months of taking ART, no HIV transmission was observed as ART consistently and durably suppressed the virus in the partner infected with HIV. While some transmission events did occur in the study, new transmissions only resulted when the partner with HIV was not fully virally suppressed due to either having just started ART or for whom treatment was no longer working and the virus was replicating again. The HPTN 052 study results, along with those of the START study, helped influence the World Health Organization in 2015 to recommend that everyone living with HIV begin treatment upon diagnosis[10] and at least with 7 days time.

1.3 Problem Statement

The treatment data presented by the USAID[2] report that was representing the whole country, showed that 61.0% of HIV+ patients started on ART immediately; the cumulative figure at least increased to 78% of those who commenced treatment by day 2-7, the figure further increased to 89.0% by day 30, whilst 93% ART initiation was reached by 90 days from the time of HIV diagnoses. It was observed that at least 22% of newly diagnosed HIV+ patients did not start treatment within the recommended time, which was as late as from day eight onwards after confirmed HIV+ diagnoses. The delay in starting treatment allows for increased VLs that enable onward transmission of the HIV to sexual partners and perinatally from the pregnant mothers. Co-morbidities and vulnerability to opportunistic infections such as Tuberculosis (TB) and a general decline in the health status, Auto-Immune Deficiency Syndrome

(AIDS)[12] and death. There is a lack of prior research studies on identifying the causes or characteristics inherent in the delay of starting ART on the same day or within the next seven days, as this was a recent change in the guidelines for all the WHO supported countries worldwide.

The WHO currently uses the term 'global epidemic' to describe HIV. As of 2018, approximately 37.9 million people are infected with HIV globally.[51] "There were about 770,000 deaths from AIDS in 2018. An estimated 1.5 million individuals worldwide acquired HIV in 2020, marking a 30% decline in new HIV infections since 2010.[51] (New HIV infections, or "HIV incidence," refers to the estimated number of people who newly acquired the HIV virus during a given period such as a year, which is different from the number of people diagnosed with HIV during a year".[51]

In Africa for 2018 it is estimated that about 25.7 million people live with HIV in Africa and that 470 000 died of AIDS related deaths an estimation of a 40% decrease since 2010. about 16.3 million people in the African Region were accessing treatment in 2018.[50] This corresponds to 64% of the total estimated number of people living with HIV who have access to antiretroviral therapy.

The first Namibia Population HIV Impact Assessment (NAMPHIA)[44] was conducted in 2017 that revealed that the annual incidence using the new HIV infection Recency testing was 0.36% for adults aged 15-64 years. By sex, it was 0.59% among women and 0.13% among men. The annual incidence was highest among men aged 35-49 years (0.53%) and among older adolescent girls and young women aged 15-24 years (0.99%).

Among all age groups, young people (ages 15-24 years) represented the sharpest contrast in HIV incidence: older adolescent girls and young women had the highest incidence at 0.99%, while older adolescent boys and young men had the lowest at

0.03%. Using the newly rolled out HIV infection recency testing, the incidence rates correspond to 4,468 (95% CI, 2,175-6,762) new cases of HIV annually among adults in Namibia in 2017.

The number of new HIV infections continues to decline and the problem remains that the progress is much slower than what is required to reach the targets for 2020. The steady scale-up of ART essentially drives the continuing decline in AIDS-related deaths in Namibia and the African Region. Hence the effective adoption of the TREAT ALL strategy is a matter of importance as there is evidence that the incidence of HIV infection reduces dracstically when people are put on ART early and should no longer delay and use treatment as prevention.

1.4 Aim of the Study

The study's main aim is to ascertain the proportion of delay, including the pattern of timing and factors associated with the delay in starting ART among confirmed HIV+ records for four districts' state facilities namely, Nyangana, Andara, Tsumeb and Oshikuku in Northern Namibia.

1.5 Research Objectives

The objectives of the study were to:

- Estimate the proportion of delay in the start of ART in the four UTAP districts.
- Identify the records and describe the characteristics of HIV positive individuals who are delayed in the start of ART in the four UTAP districts.
- Determine demographic, clinical and health service factors such as the facility type, associated with the delay in the start of ART in the four UTAP districts.
-

1.5.1 Hypotheses of the study

- HA (Alternative Hypothesis)

  The demography, clinical stage, and type of health facility of HIV+ individuals who started ART late are different from those who started ART on time.

- H0 (Null Hypothesis)

  The demography, clinical stage, and type of health facility of HIV+ individuals who started ART late are not different from those who started on time.

1.6 The Significance of the Study

Quantifying the extent of delay in starting ART and identifying the socio-demographic and other risk factors for the delay among the confirmed HIV+ population will help the MoHSS and its partners design policy and ART services accordingly. The policy and services can be tailored to the needs of the identified risk groups so that they benefit from timely initiation of treatment. Significance of timely initiation of ART; reduces morbidity, mortality and social impacts associated with late or no treatment and eliminates sources of HIV infection through viral suppression[9] that contributes to lowering the incidence of HIV in Namibia.

The recommendations from the findings of this study will contribute knowledge on the issues or reasons why newly diagnosed HIV infected individuals cannot start treatment early within the recommended same day to 7 days window. The emerging knowledge will include by the age groups, sex, WHO clinical stages or type of facilities[13] that will then be incorporated into guidelines and health care services in ART treatment, as much needed measures to close the gap on the delay in starting ART and further decrease the onward transmission of HIV, towards HIV epidemic control in Namibia and hopefully elsewhere.

1.7 Limitations of the Study

The ePMS database stores routinely collected ART patient data and serves as an electronic patient management system that is used to document all the clinical visits, blood tests done, the results for patient monitoring, medication the patient is taking the type of facility the patient is attending as the unique codes are specific to the facility that the patient started taking ART. Behavioural and other health system data (other than facility type,[13] which is included in this study) are not routinely obtainable and were beyond the scope of this study. Consequently, an assessment of behavioural and health system factors associated with delays in starting treatment could not be made.

1.8 Delimitations of the Study

This study focused on patient record entries in the ePMS who started ART after the changing of the Namibia ART guidelines in 2016. The records were taken among confirmed HIV+ records from four districts' state facilities namely, Nyangana, Andara, Tsumeb and Oshikuku in Northern Namibia. The guidelines recommended that all confirmed HIV+ clients were to start ART regardless of their CD4+ counts beginning on the day the HIV+ status is confirmed until day seven, as the recommended start date. The scope of the study is examining factors for which data can be obtained from the national HIV patient data base called herein the ePMS, further studies

1.9 Definitions of Concepts

This study used several key terms. Hence, the following definitions of key concepts of the study:

AIDS: Acquired Immunodeficiency Syndrome (AIDS) is a chronic, potentially life-threatening condition caused by the human immunodeficiency virus (HIV). By damaging the immune system, HIV interferes with the body's ability to fight infection and disease.[7,15]

Human Immunodeficiency Virus (HIV): is a virus that attacks the body's immune system. If HIV is not treated, it can lead to Acquired Immuno-deficiency Syndrome (AIDS) [7,14] and death.

Diagnosed: refers to an act of identifying the nature of an illness by examination of the symptoms, for whom a treatment or a brief psychological intervention is required.[16] Thus, in this study, the general term of 'diagnose' refers to the identification of the nature of the medical condition of a patient, which is HIV, through a confirmatory testing for the HIV antibodies hence the 'test date' in the study is represented by the repeat or HIV confirmatory test date as is found in each record.

Anti-Retroviral Treatment (ART):[1] Treatment with a combination of three or more drugs that inhibit the ability of the Human Immunodeficiency Virus (HIV) or other types of retroviruses to multiply in the body.[14] ART involves lifelong treatment. Synonyms are combination ART and highly active ART.

***The Cluster of Differentiation 4 (CD4+) cell count*:** [7] HIV infects white blood cells in the body's immune system called T-helper cells (also called CD4+ cells). These vital cells keep the body healthy by fighting off infections and diseases. The virus attaches itself to the T-helper cell and fuses with it, taking control of its DNA, creating

copies of itself, and releasing more HIV into the blood.[15] The infected CD4+ cells die and reduce in number drastically following the infection with HIV.[15] A person with a normal immune function can have anywhere from 500 to 1,500 cells/mL, while persons with a compromised immune system will have less than 200 cell/mL.

Viral Load: [10] The amount of HIV in a sample of blood taken from an HIV infected person. Viral load (VL) or viral burden is reported as the number of HIV RNA copies per millilitre (mL) of blood. It is used as a tool to monitor the effectiveness of drug treatment regimes. HIV viral loads can range from undetectable (below the detection levels of current testing assays) to the tens of millions. An important goal of antiretroviral therapy (ART) is to suppress a person's VL to an undetectable level—a level too low for the virus to be detected by a VL test.[10]

The WHO Clinical Staging for HIV: [8] These are four stages of HIV or AIDS-defining illnesses that can be observed and provide for practical and accurate way to manage HIV-infected patients in low resourced income countries or in the absence of CD4+ counts or VL testing. International studies are in agreement on the clinical manifestations included in the WHO staging system and laboratory indicators including CD4+ cell count and total lymphocyte count. The stages are known as stages I, II, III & IV.[8]

90-90-90 UNAIDS Targets: [6] The Joint United Nations Programme on HIV/AIDS (UNAIDS) in 2014 announced the 90-90-90 strategy to get the HIV epidemic under control by adopting a 'test and treat' approach. This is part of the plan to eliminate AIDS by 2030 by achieving three preliminary goals by 2020: To identify 90% of

people living with HIV through expanded testing, put on ART 90% and ensure that 90% have their VLs suppressed.

Type of Health Facility: [13] In Namibia, there are Clinics and Health Centres at Community Levels, and District Hospitals found at District Levels such as in all the UTAP districts and Intermediate Hospitals (Class 1) such as the Onandjokwe Hospital at a Regional Level.[13] Clinics are traditionally operated by Nurses only whilst offering HIV testing, and they refer patients requiring further management to the nearest Health centres or district hospitals. Health centres are also run by nurses but can have a visiting doctor at set intervals in the week or a resident doctor who attends to the patients requiring a doctor's attention and may or may not have inpatient beds. District hospitals are referral hospitals that comprise outpatient and inpatient departments and are manned by both doctors and nurses and traditionally started patients on ART before the advent of NIMART.[14] Regional hospitals are referral hospitals that receive patients from the district hospitals in each region and have specialist treatment departments and both inpatient and outpatients.

Perinatal transmission of HIV: Is the passing on of the HIV infection from the mother living with HIV to the unborn baby in the womb, during vaginal delivery and whilst breastfeeding the baby or through contaminated breast milk.

1.11 Structure of the Thesis

This thesis is divided into five chapters.

Chapter One provides the introduction and background to the central themes of the thesis. The research topic is introduced with its rationale; the research aim, objectives

and significance of the study are highlighted. Definitions of key concepts relevant to this thesis are provided.

Chapter Two presents various literature sources to place the current research into broader debates and within the experiences of factors associated with delay in starting Anti-Retroviral Treatment (ART) among confirmed HIV positive individuals in Northern Namibia.

Chapter Three presents the research methodology adopted in this study. A motivation for quantitative, exploratory, descriptive and contextual designs are provided. The rationale for adopting a non-probability purposive sampling approach and the data analysis is presented in this chapter.

Chapter Four provides the research results and the analysis of data collected through data extraction form, as the structured research instrument and the Electronic Patient Management System (ePMS) database the official Ministry of Health data base for TB and HIV care and treatment records. The factors associated with delay in starting Anti-Retroviral Treatment (ART) among confirmed HIV positive records for individuals are presented.

Chapter Five contains the summary, conclusions and evaluation of the study. The evaluation assesses the practical, theoretical and methodological contribution of the study. The focus of the summary is on the contribution of the thesis as it unfolds in the various chapters and the overall contribution in answering the research aim and

objectives. The limitations of the study and suggestions for future research are also presented.

1.12 Summary of the Chapter

This chapter presented the introduction and background to the study. The introduction, the problem statement, research aim, objectives and the significance of the study are reflected in this chapter. The chapter further provided context on the definitions of key concepts, limitations, delimitations and thesis structure. The next chapter will focus on the contents of the literature review of this study

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The chapter contains a literature review on the aspects of the overview of the factors associated with delay in starting Antiretroviral Treatment (ART) among confirmed HIV+ records in the ePMS data base for four districts' state facilities namely, Nyangana, Andara, Tsumeb and Oshikuku in Northern Namibia. A literature review is defined as a basic outline of research on a subject of interest,[17] in this circumstance, it is the variables impacting the factors associated with delay in starting ART among confirmed HIV positive individuals in Namibia. The literature review places the study within the larger picture of what is being discussed, allowing for comparisons, arguments, critiquing whilst the work is drawing upon, departing from or adding a new perspective to what has been said in the literature.[17]

Preceding the conclusion of this chapter, the topics on HIV, AIDS and ART and elsewhere, including the developed countries, has been explored in greater detail. The chapter presents specific content on different aspects of HIV/AIDS and ART in Namibia, Africa and globally presented as a backdrop or proxy as progress achieved this far before the advent of the Treat All strategy.

2.2 HIV/AIDS and Antiretroviral Treatment in Namibia

In 2003, the Government of Namibia launched the national antiretroviral therapy program to provide treatment for people living with HIV or suffering from AIDS in government health facilities. Since the program was launched, the MoHSS has trained medical practitioners from public and private sectors.[18] Namibia's population is estimated at 2,533,794 people, with a per capita income of US$10,320, a life

expectancy of 65 years for females and 62 years for males at birth, and the country has an infant mortality rate of 36 for the 1,000 live births.[19]

The National Strategic Framework (NSF) of Namibia is a five-year HIV and AIDS policy and planning document (2017/18 to 2021/22) developed to guide national HIV policies, practice, and implementation performance of the national multi-sectoral and decentralised HIV and AIDS response.[20] The design of the NSF is premised on the Investment Framework and Results-Based Management (RBM) approaches. These approaches have also mainstreamed gender and human rights issues. The NSF has prioritised interventions, as seen in Table 2.1, that will contribute to the achievement of the following impact results by 2022.[20]

Table 2. 1: National priorities and results for Namibia

No.	Priority	Targeted Impact Results
1.	Priority 1	HIV new infections reduced by 75%.
2.	Priority 2	HIV related deaths reduced by 75%.
3.	Priority 3	Elimination of Mother to Child Transmission (MTCT) to less than 2%.
4.	Priority 4	100% of newly identified People Living with HIV (PLHIV) enrolled and retained on ART.
5.	Priority 5	TB/HIV mortality reduced to 21 per 100,000 population by 2021.
6.	Priority 6	Domestic contribution towards the national multisectoral HIV and AIDS response increased to 80%.

Adopted from: NSF.[20]

The Government of Namibia (GRN) and the United States of America (U.S.) President's Emergency Plan for AIDS Relief (PEPFAR) have partnered since 2003 to develop vital capacity and systems for the HIV/AIDS response.[21] The two PEPFAR

donor agencies, the U.S. Agency for International Development (USAID) and Centres for Disease Control and Prevention (CDC), and their implementing partners support a wide range of HIV services at all health system levels. In 2014 GRN and the US Government signed an agreement to implement a Country Health Partnership, a collaborative approach initiated in 2013[22] to strengthen the "shared responsibility, mutual accountability, and budget transparency" of PEPFAR-funded programs.[23] In 2015, the partnership culminated in a two-year Treatment Acceleration Plan intending to achieve 95% ART coverage for eligible PLHIV by the end of September 2017, an NSF[20] set target.

Table 2. 2: Achievements on HIV/AIDS and Antiretroviral Treatment in Namibia

No.	Component	Indicators
1.	HIV infections.	Namibia decreased HIV infections from more than 15,000 in 2002 to approximately 4,500 in 2018.
2.	AIDS-related deaths.	Namibia decreased AIDS-related deaths in 2018 by half from nearly 10,000 deaths in 2002.
3.	Antiretroviral therapy.	Namibia to reach the UNAIDS 90-90-90[26] targets of providing antiretroviral therapy for 90% of those diagnosed and ensuring 90% of those treated achieve viral suppression by 2030.
4.	HIV treatment.	Continuing to provide support to reach the UNAIDS 95:95:95[27] target for treatment: 95% of people living with HIV knowing their HIV status; 95% of people who know their status put on treatment; and 95% of people on treatment with suppressed viral loads.

Adopted from: Namibia CDC.[21]

To meet this target, as shown in Table 2.2, ART services would need to be expanded in geographic regions with 80% of the HIV disease burden[25] and where the unmet need for ART was highest.[24] The partnership identified eight high-burden regions comprised of 17 districts and eight urban hotspots (small locations in bigger towns with high HIV prevalence or incidence),[26] and set targets to expand the number of

"high-volume" facilities that provide comprehensive ART services from 31 to 144 and initiate 38,615 adults on ART.[24]

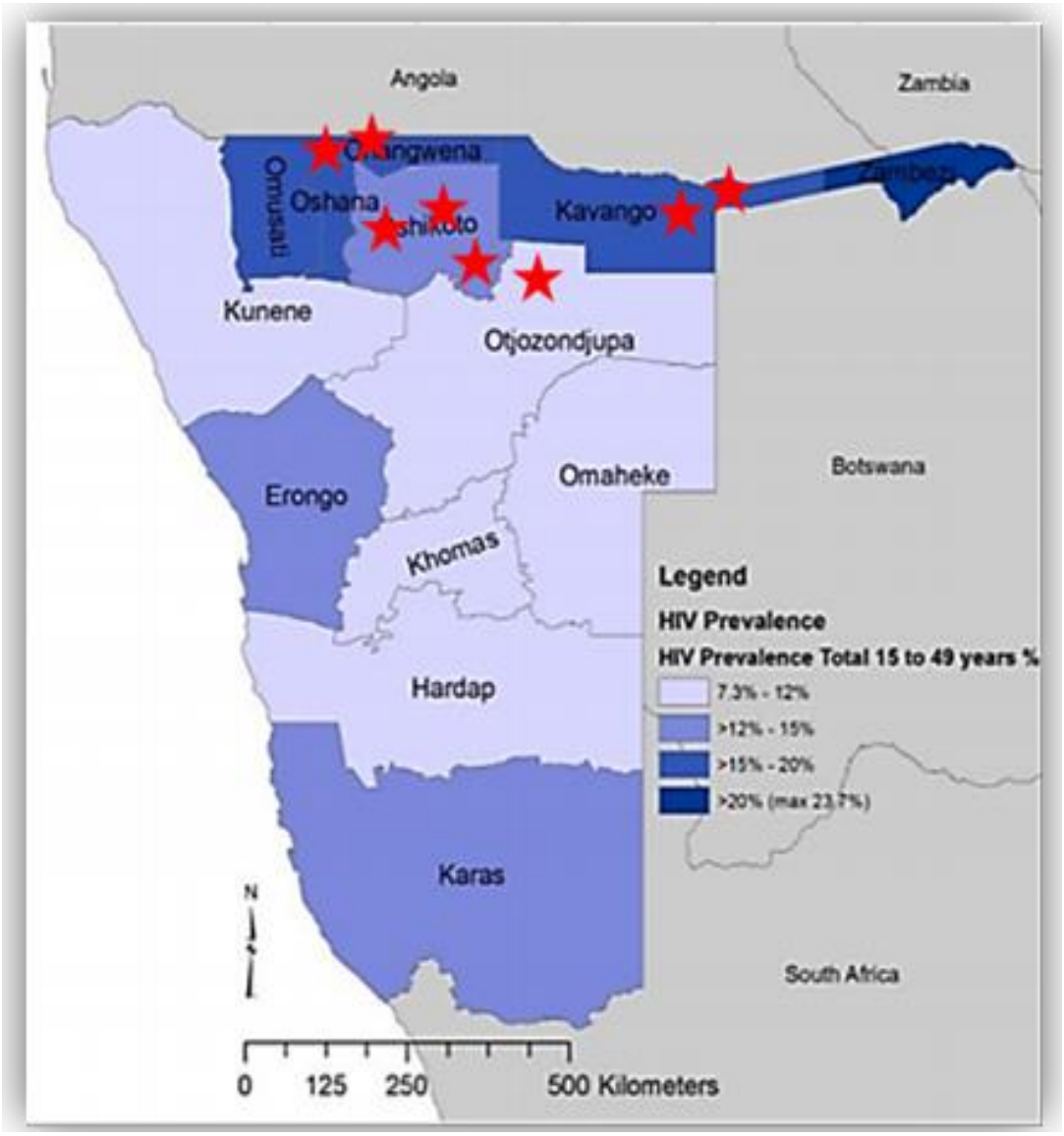

Figure 2. 1: Regional HIV prevalence and districts where UTAP Was Implemented

Adopted from: NAMPHIA. [44]

The UTAP, implemented by IntraHealth International in partnership with the GRN through the MoHSS and Faith-Based Organizations (FBOs), was USAID's flagship project for clinical HIV services from 2015-2019. The project scaled up comprehensive HIV services in seven high-burden districts and one hotspot in

Grootfontein, as seen in Figure 2.1, which oversaw 41 (28%) of the 144 sites earmarked for support through the Country Health Partnership.[21]

The data for the four high HIV burdened districts of Nyangana, Andara, Oshikuku and Tsumeb districts were used for this study.

Figure 2.1 depicts the map of Namibia showing regional HIV prevalence and districts where UTAP worked and implemented the following key interventions: task-shifting to nurse-managed ART, transitioning to provider-initiated HIV testing and counselling, closing the HIV treatment gap, linkage to care, continuous professional development through HIV clinical mentorship, ensuring quality in viral load monitoring, ensuring quality in viral load monitoring, prevention of mother-to-child transmission and electronic patient management system, as discussed below. Quality data systems supported these to inform decisions about whether the approaches were achieving their intended results.

2.2.1 Task-Shifting to Nurse-Managed ART

Nurses operate and manage Primary Health Care (PHC) facilities in Namibia, providing a range of integrated services. The MoHSS published a report in 2015 that revealed health centres and clinics only had 85% and 77%, respectively, of the nurses they required to provide health services, including HIV care and treatment.[27] Prior to 2014, doctors were the only health workers legally authorised to initiate ART, and they were primarily based in hospitals, with some districts also conducting outreach to PHC facilities to initiate ART. Even with the adoption of the World Health Organization (WHO)'s Integrated Management of Adolescent and Adult Illness (IMAI) guidelines, enabling nurses to provide some HIV services, including clinical follow-up of stable patients on ART, patients still had to travel long distances to

initiate treatment. As the workload for ART initiation increased, decentralisation of ART services to PHC facilities became inevitable, increasing the PHC nurses' workload more.

Nurse-Initiated Management of ART (NIMART) was first tested in Namibia in 2011 as part of a task-shifting demonstration project, which was feasible and acceptable.[28] In April 2014, the GRN approved legislation to expand nurses' scope of practice to include ART initiation and follow-up care for both adults and children thereby endorsing the task-shifting intervention.[28] The Health Professions Council of Namibia, the regulatory body for professional development of health workers, supported the legislation. UTAP leveraged the new policy by providing training, certification, and mentorship in NIMART for nurses in PHC facilities, tuberculosis departments, maternity services, and inpatient and outpatient departments. This facilitated the decentralization and integration of ART with other health services in hospitals and PHC facilities.

2.2.2 Closing the HIV Treatment Gap

The MoHSS has provided ART since 2003. Until 2016, eligibility for ART initiation was based on clinical and immunologic criteria. At the time, patients not yet eligible (known as pre-ART) received a care package that included CD4+ count monitoring, opportunistic infections screening and preventative therapy.[31] As Namibia prepared to rollout ART services, the MoHSS identified congested clinics and a shortage of health workers skilled in ART management as significant challenges.[20] The MoHSS launched the fifth edition of the national ART guidelines in November 2016, which incorporated strong recommendations from the WHO on the benefits of early initiation of ART.[32,33] These guidelines made all PLHIV eligible to start ART regardless of their

clinical or immunological status[34] - an approach known as "Treat All." When Treat All was launched, only 70% of PLHIV were on ART, and approximately 71,000 needed to be initiated, most of them in high-burden regions as defined by the Country Health Partnership.

To support the rollout of Treat All, UTAP hired various cadres of contract health workers (nurses, health assistants, pharmacy assistants, doctor and nurse mentors, data clerks, and monitoring and evaluation officers) to deliver facility-level HIV prevention, testing, and treatment services. UTAP partnered with the MoHSS and FBOs to assess health facility human resource needs and recruit and assign health workers to facilities. To address the shortage of nurses, UTAP hired recently retired nurses. The project gave district and regional management orientation in the Treat All guidelines and trained contract and MoHSS health workers in PITC, Treat All, and NIMART. UTAP deployed contract health workers to hospital ART clinics and PHC facilities, where they spearheaded the implementation of Treat All.[34]

2.2.3 Linkage to Care

Before Treat All was rolled out, linkage to ART was passive, and there were long delays between HIV diagnosis and ART initiation. As UTAP rolled out Treat All, it reviewed and streamlined the standard operating procedures for linking HIV-positive patients to ART services. UTAP mentored all health assistants (a lay cadre responsible for HIV testing services and adherence counselling) on the benefits of timely linkage to care and required each health assistant to document the linkage outcome of newly diagnosed HIV-positive clients. The health assistants were responsible for registering new positives for ART services and providing ART initiation counselling. In some

facilities, ART services were integrated with PITC, and clients received HIV testing and ART initiation in one place.

In facilities where integration was not feasible, health assistants physically escorted the client to the ART clinic, registered them, and handed them over to one of the nurses on duty for further management. Clients who preferred to start ART at another facility were given the option to start ART before being referred. Clients who were not yet ready to start ART received ongoing care and counselling from a multi-disciplinary team consisting of a doctor, nurse, pharmacist assistant, and health assistant, and with the option for referral to a social worker or community health worker if needed. Support from a multidisciplinary team helped ensure thoroughness in mitigating the barriers to initiating ART. UTAP monitored facility performance in linkage to care monthly and quarterly and provided Quality Improvement (QI) support to underperforming sites.

2.2.4 Continuous Professional Development through HIV Clinical Mentorship

Clinical mentorship is a "system of practical training and consultation that fosters ongoing professional development to yield sustainable, high-quality clinical care outcomes."[35,36] A clinical mentor should have extensive clinical experience and good teaching skills. The WHO recommends clinical mentorship as one of the strategies to support the scale-up and decentralisation of ART services.[35] The MoHSS introduced the national HIV clinical mentorship program in 2006 and has since received support from various PEPFAR implementing partners, including UTAP. Prior to 2015, the national program only had a few clinical mentors supporting multiple regions. This limited their ability to provide meaningful onsite support, particularly in the high-burden regions.

The UTAP clinical mentorship team consisted of doctors and nurses who provided training and onsite and remote mentorship in HIV prevention, testing, and treatment services. Nurse mentors supported day-to-day mentorship activities of facilities within a district, while doctor mentors coordinated mentorship activities in two or more districts and oversaw the management of complicated cases like treatment failure and comorbidities.

The UTAP clinical mentorship team played a critical role in driving the rollout of Treat All.[34] The team worked with district and regional management to identify and train a cohort of doctors and nurses as Treat All trainers. To ensure Quality in Viral Load monitoring, in partnership with the MoHSS, USAID, and CDC, UTAP provided technical support to strengthen the quality of district and facility VL monitoring services

2.2.5 Electronic Patient Management System (the ePMS)

Current and accurate patient data measure the continuity of care from HIV testing to initiation and continuous adherence on treatment to the goal of viral suppression. In 2006, IntraHealth International an NGO, developed and tested an electronic ART Patient Management System (the ePMS) in a hospital it supported. The MoHSS eventually adopted ePMS nationally and rolled it out to all 34 district hospitals. The ePMs captures HIV care and treatment information from individual patient medical records and allow facilities to track patients and services longitudinally. The MoHSS utilizes aggregate ePMs data to monitor district, regional, and national performance against ART indicators and targets. Using the Partnership Framework[41] approach to

build ownership and capacity, IntraHealth International handed over ePMs to the MoHSS by 2013 while building MoHSS capacity to use the data and manage the information system. At the request of the MoHSS, IntraHealth upgraded the system in 2015 and redesigned it to ePMS Quantum to meet the national need to capture HIV continuum of care data and track individual clients across facilities from 2016-2019.

2.3 HIV/AIDS and Antiretroviral Treatment in Africa prior to Treat All strategy

Since 2001, the international effort to scale up ART in the developing world has been one of the most important programs in global health.[45] Initially, there was considerable reluctance to provide ART in developing countries due to concerns that treatment was too expensive, too complex, and inadequate programs would promote that drug resistance.[46] In particular, it was argued that ART was not cost-effective and that prevention interventions should be prioritised.[47,48] "The high cost of treatment was reduced through advocacy to promote access to generic drugs; care provision was simplified through a public health approach to treatment provision; the lack of human resources was overcome through task-shifting to support the provision of care by non-physicians, and access was expanded through the development of models of care that could work at the primary care level".[49]

Effective management of HIV infection is possible using different combinations of available drugs. This method of treatment is collectively known as ART. Standard ART comprises a concoction of at least three medicines (termed as "highly active antiretroviral therapy" or triple therapy).[49] Effective ART often helps control the multiplication of HIV in infected patients and increases the count of CD4+ cells, thus, prolonging the asymptomatic phase of infection, slowing the progression of the disease, and helping reduce the risk of onwards transmission.

2.4 Factors Associated with Delay in starting Antiretroviral Treatment globally prior to Treat All strategy

ART using three-drug combinations remained complex, with multiple tablets, complicated schedules, and the need for extensive monitoring, most preavalent in poor countries.[55] Poor funding and infrastructure, and sometimes political opposition, challenged many countries that considered an expanded provision of ART. Forsythe[55] maintains that treatment was expensive, at USD $10,000–$15,000 per patient per year. In 2000 the Accelerating Access Initiative of the WHO significantly reduced antiretroviral prices for thirty-nine countries, and the WHO also launched prequalification for generic antiretroviral.55 The Global Fund to Fight AIDS, Tuberculosis, and Malaria (Global Fund) was established in 2002, followed in 2003 by President George W. Bush's $15 billion US President's Emergency Plan for AIDS Relief [PEPFAR]. [55]

Moves to reduce prices resulted in the World Trade Organization's Doha Declarations, which allowed countries to manufacture generic medications to address public health crises.[56] Starting in 2006, some major originator companies for antiretrovirals signed voluntary licenses, enabling generic companies to sell antiretrovirals at significantly reduced prices in developing countries.[55] In addition, patent pools, through which drug manufacturers can obtain the rights to manufacture needed formulations, gave countries access to various combinations of antiretrovirals with reduced royalties to manufacturers. [58]

Access to and the effectiveness of ART evolved dramatically worldwide. Single-tablet regimens, led by Atripla in 2006, replaced multiple daily doses.[58] Side effects of treatment were reduced dramatically, limiting regimen changes and drug resistance while increasing the quality and length of life for people living with HIV.[59]

Various researchers have attempted to quantify the change in life expectancy attributable to the evolution in the effectiveness of ART.[60] The most comprehensive data on changes come from Brazil, an early adopter of ART and has been able to monitor changes in life expectancy over time.61 The gains in life expectancy for people initiating ART rose dramatically in Brazil, from 3.3 years in 1997 to 25.7 years in 2014.[55]

To realize the potential offered by advances in treatment effectiveness, UNAIDS established the 90-90-90 treatment targets in 2014.[58] These targets aim to "eliminate AIDS by 2030" by ensuring that 90 percent of people living with HIV know their HIV status, 90 percent of those who are diagnosed (81 percent of all people with HIV) receive treatment, and 90 percent of those (73 percent of all people with HIV) have viral suppression by 2020. [58]

2.5 Factors Associated with Delay in starting Antiretroviral Treatment in Sub-Saharan Africa prior to Treat All strategy

The UNAIDS (2015) stated that "HIV is entirely suppressed in only one-in-four people living with HIV in sub-Saharan Africa, so urgent attention is needed to address service gaps that prevent communities achieving the full health benefits of antiretroviral therapy. [50]

Closing the gaps in treatment demands concerted efforts at each step of the process – starting with HIV testing. "The number of people tested for HIV has steadily increased in sub-Saharan Africa – by more than 9% in 2012 alone – yet most men and women in the region living with HIV have never been tested and thus do not know their current status". [53p7]

Multiple strategies are needed to close the HIV testing and counselling gap in sub-Saharan Africa, including fully implementing HIV testing and counselling in diverse settings.[50] "Kenya, Malawi, South Africa, Uganda, the United Republic of Tanzania and Zambia have integrated the promotion of HIV testing and counselling in community campaigns that provide screening and prevention services for multiple diseases". "Political and community leadership and community-based measures all play a key role in increasing access to ART and improving people's knowledge of their HIV status while respecting their right to confidentiality". [53p7] This allows people living with HIV to be reached at an early stage of infection and to receive appropriate care, treatment and prevention services.

Many people diagnosed with HIV do not ultimately receive the services they need, while many who initially access services are not retained in care.[53p8] Studies from across sub-Saharan Africa continue to document high losses of treatment-eligible patients from care before receiving their first dose of ARVs, due to a wide range of facility and patient-level barriers to initiation. These barriers range from multiple required clinic visits, walk in systems coupled with long waiting times, in the absence of booking systems, stock outs of supplies, staff absences, and poor communication between staff and patients, which all deter treatment initiation. Strengthen the capacity of service providers – including Training, Mentorship and periodical supervision. [5]

2.6 Factors Associated with Delay in starting Antiretroviral Treatment in Namibia prior to Treat All strategy

Table 2.3 shows that the retention in care after testing positive for HIV and starting on ART is dependent on interlinked factors. The interlinking factors include accessibility of services, nature of ART regimens used, services provided, competing priorities,

stigma and discrimination, as seen in Table 2.3. Now that the treatment guidelines have changed from the old that was mainly monitoring the CD4+ counts until they were eligible to start ART, as ART care and starting the patients only when their

Table 2. 3: ART - Gaps, Challenges and Interventions prior to Treat All strategy

No.	Gap/Challenge (Behavioural/Structural/Biomedical)	Key Interventions
1.	There is an uneven ART coverage by age and sex.	Provide ART to all PLHIV sub-groups to ensure that ALL age/sex groups achieve a minimum of 81% coverage by 2022.
2.	There is an uneven ART coverage by geographic location.	Scale-up ART coverage to ensure that ALL health districts achieve a minimum of 81% ART coverage by 2022.
3.	Limited Human Resource Capacity.	• Recruit and retain adequate staff to provide ART Services. • Implement Task Shifting by Training and certification of Nurses in the Nurse Initiated Management of ART. • Strengthen the capacity of service providers – including Training, Mentorship and periodical supervision.
5.	Limited access to ART services.	Scale-up Differentiated Service Delivery Models - including Community-Based ART delivery.

Adopted from: Namibia CDC.[21]

immune system had weakened; the study is being conducted after the launch of the Treat All strategy, to ascertain the proportion of delay in the start of ART in the four UTAP districts. To enable painting a picture by describing the characteristics of HIV positive individuals who are delayed in the start of ART in the four UTAP districts whilst determining the demographic, clinical and health service factors such as the facility type, associated with the delay in the start of ART in the four UTAP districts.

So that further interventions can be tailormade to curtail the obstacles causing delays in starting treatment within 7 days of knowing that one is living with HIV.

2.7 Summary of the Chapter

The literature reviewed and presented in this chapter does not only apply to the Namibian context. Therefore, some factors that have been presented in the literature review are drawn from conclusions and deliberations that were compiled based on research conducted in other African and developed countries globally. This suggests that the factors associated with delay in starting ART presented in this literature review might not be the same ones that affect HIV+ patients in Namibia. However, this literature review has been used to meet the research objectives set for this study in response to the research gaps.

The next chapter presents the research methodology of the study. Chapter three presents and discusses in detail the quantitative research methodology, a retrospective cross-sectional analytic design, because of the study's ability to examine relationships between delay in the start of ART and other variables of interest, the methods of data collection, study population and samples, data analysis and ethical considerations that were used to carry out the study.

The prevalence of demographic and other risk factors (exposure) and the prevalence of delay in the start of ART (outcome variable) are to be measured simultaneously whilst the variables of a person's well-being such as CD4+ counts levels at enrolment to treatment will be observed as possible contributors to the delay in starting ART.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

The chapter contains the context, explanations and descriptions of the research methodology. The research design that will address the planning of a scientific enquiry which refers to an overall strategy for finding out something, including the population, the sample size and sampling methods used in this study, are described and explained. The research design refers to the blueprint or how a study is structured to conduct it successfully and highlights the methods and tools used during the research process.[63] In response to the research problem statement, the research design and methodology is aimed at addressing the research objectives, research questions and research hypotheses of the study. [63]

The chapter further includes the data collection subsection, where the aspects of the research instruments, the procedure for data collection, trustworthiness and the pilot study are described and explained. The data analysis and the research ethics are also described and discussed. The chapter then ends with a summary of the chapter.

3.2 Research Design and Methodology

A quantitative research method was preferred, and a retrospective cross-sectional analytic design was used because of the study's ability to examine relationships between delay in the start of ART and other variables of interest. The prevalence of demographic and other risk factors (the exposure) and the prevalence of delay in the start of ART (the outcome variable) are to be measured simultaneously.

3.2.1 Quantitative Design

Quantitative methods emphasize objective measurements and the statistical, mathematical, or numerical analysis of data collected through polls, questionnaires, and surveys or by manipulating pre-existing statistical data using computational techniques.[63] Quantitative research focuses on gathering numerical data and generalizing it across groups of people or explaining a particular phenomenon.[63]

Quantitative methods often fall into two distinct categories – descriptive studies (often 'hypothesis generating') and hypothesis-driven studies.[64] In this study, the quantitative nature falls into both descriptive and hypothesis categories. Quantitative research methods are known and accepted in applied health and social care research. They use objective measurements with statistical methods, mathematics, economic studies or computational modelling to enable a systematic, rigorous, empirical investigation. In this study whilst using records stored in the the ePMS data base for four districts' state facilities namely, Nyangana, Andara, Tsumeb and Oshikuku in Northern Namibia, the descriptive will be used to examine trends and patterns in public health care that will help planning and monitoring, this refers to frequencies, averages and other statistical calculations,[65] related to delay in starting Anti-Retroviral Treatment (ART) among confirmed HIV+ individuals. It is important to remember that not all quantitative research involves experimental studies - important results can also be drawn from quantitative observational studies.[64]

3.2.2 Time Series Analytic Design

An analytical time-series study is a type of quantitative, non-experimental research design. These studies seek to "gather data over a period in time"[5] as is the case with this research, from 1 July 2017 to 30 June 2018. A time-series study examines the

relationship between disease (or other health-related state) and other variables of interest as they exist over some time.[68] The purpose is to measure the association between an exposure and a disease, condition or outcome within a defined population. In this study, the researcher's goal was to ascertain the proportion of delay in starting ART among confirmed HIV positive individuals records stored in the ePMS data base for four districts' state facilities namely, Nyangana, Andara, Tsumeb and Oshikuku in Northern Namibia.

3.3 Population

Population refers to all the people that would fit into the group considered by a particular study. A sample is then drawn from this population.[64] In this study the study population; from secondary data already disaggregated in the ePMS database, comprises of 1824 patient records who had started ART in the state health facilities in four UTAP districts' state facilities namely, Nyangana, Andara, Tsumeb and Oshikuku in Northern Namibia since the adoption of the 'Treat All' policy by MoHSS in 2016. A period of 12 months, July 2017 until June 2018, when the policy was reasonably implemented. This is essentially a desk review study conducted from the data that is already gathered from the districts and being kept at the national level monitoring and evaluation department in the MoHSS in Windhoek.

3.4 Sample and Sampling Method

A sample is defined as a subset of a population selected to research the population without having to collect data in its entirety.[64] Whereas, the term sampling method "means selecting the group that the researcher will collect data from for their

research".[64] In this study, a total population sample was employed to study secondary data already disaggregated in the ePMS collected from the four UTAP districts.[70]

3.4.1 Variables Considered in this Study

Creswell[64] defines the term variable as a characteristic or the attribute of an individual or an organization that can be measured or observed and varies among the people or organization being studied. The variables of interest in this study included independent and dependent variables.

3.4.1.1 Dependent Variables

According to Creswell[64] dependent variables depend on the independent variables; they are outcomes or results of independent variables; they are also called criterion, outcome, effect, and response variables. The delay in starting ART is the dependent variable under consideration in the present study.

3.4.1.2 Independent Variables

Independent variables cause, influence, or affect outcomes; they are also called treatment, manipulated, antecedent, or predictor variables.[64] The delay in starting ART is the only dependent variable and the following independent variables were considered relevant to this study: age, district and sex. The markers of a person's well-being such as the WHO Clinical Stage at Start of ART, CD4+ counts and type of health facility providing ART at enrolment to treatment will be observed as possible contributors to the delay in starting ART.

3.5 Data Collection Instrument

The research utilized secondary data from records retained in the ePMS database, which had information on the four UTAP districts state health facilities namely, Nyangana, Andara, Tsumeb and Oshikuku in Northern Namibia included in the study. The ePMS database in the patient master data lists, had all the information of the dependent and independent variables. This included the date of start of ART after confirmation of HIV positive status herein known as the ART start date. The start date marks and controls the commencement of ART whilst delay in the start of ART is defined as, the failure to initiate ART within seven days of a confirmed HIV+ diagnoses. The key exposure variables are demographic (age, sex, place of residence); clinical (the baseline CD4+ count at the start of ART and the type of health facility providing ART .

3.5.1 Procedures

The researcher conducted a pilot test by utilising secondary data in the ePMS database from Andara hospital and the Grootfontein Poly Clinic, where the sample data was collected and compared to the ePMS records and this took half a day to complete as each PCB could take half an hour to compare with the diagregated national levelthat is uniquely coded without names data.This was done through randomly selecting 20 Unique Patient ID numbers from the national level ePMS starting with the 12 months, July 2017 until June 2018 from the time when the policy was reasonably implemented. The researcher compared the information with the Patient Care Booklets (PCBs)[72], the source of the patient data. The researcher reviewed each patient data for completeness as per the variables in the pre-prepared data extraction form.[72] Then, fine-tuned the data as the lessons learnt.

Data were then extracted from records from the ePMS that is situated at national level in Windhoek and filtered by dates of ART starting from July 1st, 2017 until June 30th 2018 and saved/published on an excel spread sheet (form). Each row represents a patient record, with each record assigned a unique identifying code and each column to represent the variables of study interest.

3.6 Data Analysis

Data analysis is a close or systematic study, or the separation of a whole into its parts, for the study. Data analysis consists of three flows of activity: data reduction, data display and conclusion drawing and verification. [75] Data analysis was conducted using Microsoft Excel and Microsoft Word. The analytical techniques used in the data analysis include descriptive statistics and multivariate analysis.[74] Therefore, the Statistical Package for Social Sciences (SPSS) version 27 was used to develop the analytical model.

3.6.1 Analytical model

The research sought to answer the hypothesis given in chapter 1:

H0: There is no relationship between demographic, clinical and health service factors with delay in the start of ART in the four UTAP districts.

HA: There is a relationship between demographic, clinical and health service factors that is the facility type, with delay in the start of ART in the four UTAP districts.

Hence, the multivariate logistic regression model had the following assumptions as identified by Creswell[63] (p302) There is no positive corelation between the dependent and independent variables; dependent variables must be dichotomous,

meaning that the independent variables need not be interval, normally distributed or linearly related and of equal variance within the group. The category for the dependent variable must be mutually exclusive and exhaustive and should always be involved in a large sample due to the fact that maximum likelihood coefficients are large sample estimates.

3.6.1.1 Model estimation

The initial objective in model estimating was to convert the predictor variable and calculate the coefficients of the predictor variables, which was the first step.[63] The most fundamental multivariate logistic regression analysis commenced with the logit transformation of the dependent variable, followed by the use of maximum likelihood estimation. The use of the odd ratio accomplished this:[63]

Equation 1:

$$odds\ (pi) = [\frac{pi}{1-pi}] = e^{bo+b1x1+\cdots bn\,xn}$$

Where pi is the probability of an event i,

$bo + b1x1 + \cdots + bnxn$ represents the regression model.

(Odds ratio)

The odds ratio shows all event probability relationships and the exponential nature of those interactions. Hence, it had several beneficial qualities, the most important is that it depicted the higher or lower possibility of an event result occurring. In cases where the odds ratio <1, then the possibility of an event happening had reduced, and if the odds ratio >1, the possibility of an event happening had increased. The odds ratio measures the likelihood that a specific binary event will occur when a particular model estimating method is used to calculate it.[64] Because of the logit transformation, it is transformed into a continuous function.

Thus the model was as follows:

Equation 2:

For k explanatory variables and i=1,...,n individuals, the logit model is

$$logit(\pi_i) = log\left(\frac{\pi_i}{1-\pi_i}\right) = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \cdots + \beta_k x_{ik} \quad (4.1)$$

where π_i is the probability that $y_i = 1$, β_0 is the intercept parameter, $\beta_i (i = 1, 2, ..., k)$ are the slope parameters, and x_i stand for explanatory variables. The expression on the left-hand side is the logit or log-odds.

$$\pi_i = P(Y_i = 1 | X_i = x_i) = \frac{exp(\beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \cdots + \beta_k x_{ik})}{1 + exp(\beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \cdots + \beta_k x_{ik})} \quad (4.2)$$

3.7 Validity and Reliability

Validity and reliability are ensured by using the whole data entered into the ePMS, disaggregated, analysed, and reported at the national level. Accuracy is therefore maintained since selection bias, information bias and confounding bias are eliminated that usually result in systematic sampling error, systematic measurement error and confounding occurring.[74]

The use of secondary data ensures replicability of study findings and, therefore, avails greater transparency of research procedures and integrity of the research work. The ePMS database stores a vast amount of records routinely collected through the patient management information system that is of high quality and representative of the population.[73]

Reliability or the repeatability or reproducibility of the same result, if the measurement were taken or the study repeated is safeguarded when studying a whole population. The measurement instrument will ensure the degree of similarity of the results

obtained when the measurement is repeated on the same group of people. The measurement instrument will measure what it is intended to measure.[74]

As part of the pilot testing of the instruments and procedures of the study, the accuracy of the ePMS as HIV patient data management system was verified by randomly selecting records of 20 patients who started ART during July 2017 to June 2018 from the ePMS and comparing with those 20 patients' medical records/Patient Care Booklets(PCBs) from their source facilities (see data validation form as Annexure 3 with the data extraction form). Achieving at least a 90% agreement score was the warranty accuracy of the ePMS as a data source for this study.

3.8 Research Ethics

The ethical issues inherent in this study are that the population's HIV+ status which makes them vulnerable to unintended and accidental disclosures. All care and adherence to the ethical principles of research were adhered to uphold autonomy, respect and confidentiality, justice, and to do no harm to any persons whose particulars/records are being kept in the ePMS database. The whole research process involves ethical considerations, whether any primary data collection is involved. This starts from the initial design of the study, whose aim is at the public good, not harm and continues until communication of results, which should ensure transparency, openness and replicability.

The use of secondary data stored in the ePMS database is a highly ethical practice that maximizes the value of any (public) investment in data collection and reduces the burden on respondents. The records when viewed at secondary levels has no identifying information or is completely devoid of such information and is appropriately coded and anonymous so that the researcher does not have access to the

codes. Secondary data benefits outweigh the risks, especially regarding re-identifying individuals and disclosing sensitive information. Un-identifiable or anonymization of records allows researchers to make information derived from personal data available in a rich and usable form while protecting individual data subjects. The existing data can therefore be analysed to generate new hypotheses or to answer critical research questions.[13]

For this study, an ethical clearance certificate was granted by UNAM Human Research Ethics Committee for human subjects (HREC), and permission was granted from the MoHSS in the form of IRB clearance to access and utilize patient records stored in the ePMS. Patient data were extracted at the national level by those who have the authorization to access and the responsibility to manipulate ePMS data. Neither the investigator nor any other research assistant had access to national level disaggregated data in the the ePMS. Once the data was extracted and saved on excel spreadsheet (data extraction form), it was password protected and given to the researcher with the password for cleaning and analysis. The data will be kept for the duration of the study and deleted as soon as the study is concluded and marked since the data from the ePMS is in retrospect.

3.9 Summary of the Chapter

The chapter has presented the research methodology's experiences, context, explanations, and descriptions. The research design, the population, the sample size and sampling methods used in this study were described and explained. Issues surrounding the quantitative research methods have been detailed, and based on the attributes of this study, the quantitative research method was selected as the most appropriate for this study.

The chapter further included experiences, descriptions and explanations of the data collection, where the aspects of the research instruments, the procedure for data collection, trustworthiness and the pilot study are also described and explained. The data analysis and the research ethics are also described and discussed. The chapter then ends with a summary of the chapter.

Chapter four presents and shares the experience on the research results and findings of the study.

CHAPTER FOUR

DATA ANALYSIS AND DISCUSSION

4.1. Introduction

Chapter Three (Research Methodology) was designed to address the "how" part of the study; that is, it addressed the research methods that were utilised to address the study's central theme: the factors behind the delay in ART initiation by confirmed HIV+ patients from four selected Regions, which are: Andara, Nyangana, Oshikuku, and Tsumeb. Therefore, this chapter (Chapter Four) goes a step further and looks at the analysis of data, the discussion of findings, and literature control. This descriptive study sought to address the following objectives:

1. Estimating the proportion of delay in the start of ART in the four UTAP districts of Andara, Nyangana, Oshikuku, and Tsumeb records.
2. Identifying and describing the characteristics of HIV positive individuals records who are delayed in the start of ART in the four UTAP districts.
3. Determining demographic, clinical and health service factors associated with delay in the start of ART in the four UTAP districts.

To provide answers to the descriptive objectives of the study, the percentage distribution of time of the start of ART since confirmed HIV+ was calculated to provide an estimate of the prevalence of delay in treatment with a 95% confidence interval and displayed the trend in time of the start of ART in Tables and graphs format. The percentage distribution of delay in the start of ART was calculated according to categories of the above-stated exposure variables and presented in Tables and graphs, e.g. % delay in days 1-7 compared to day 8-14, 15-30, Months 1-6 and Months 7-12.

For the analytic objective, the prevalence ratio with 95% confidence interval and p-value was calculated to examine the association between the binary primary outcome variable (delay in the start of ART vs on-time start of ART) and each of the categorical exposure factors presented in Tables. To look for exposure factors that are independently associated with delay in the start of ART after adjustment for confounding and interaction, the individual risk factors were fitted forward into a multivariable logistic regression model. The multivariable logistic regression analysis results were presented in an odds ratio with 95% confidence intervals.

4.2 Descriptives

Under this section, the researcher analysed the data using the following scores: frequency distribution and percentages. Under this category, the researcher looked at the trends in the fields associated with the factors linked to the delay in the uptake of ART. The descriptive is going to be discussed following the sequence of objectives as done below:

4.2.1. Objective one: Proportion of delay in starting ART in the four UTAP districts of Andara, Nyangana, Oshikuku, and Tsumeb patient records

4.2.1.1. ART start day (district cross-tabulation)

The researcher created this variable to determine which days those who were confirmed HIV+ first took their ART to measure the delay in the start of ART in four regions of Namibia (Andara, Nyangana Oshikuku, and Tsumeb) records. The analysis (descriptive statistics) in Table 4.2 below used frequencies and respective percentages

on start days by district. The start days were categorised as follows: 1, 7, 14, 30, 90, 180, and 365 (in days).

Table 4. 1: Art start day (district cross-tabulation)

63ART_start_Day_group * District Cross tabulation

			District				
			Andara	Nyangana	Oshikuku	Tsumeb	Total
ART_start_Day_group	1.00	Count	426	189	538	157	1310
		% within District	72.2%	75.9%	71.4%	67.7%	71.8%
	7.00	Count	81	27	108	43	259
		% within District	13.7%	10.8%	14.3%	18.5%	14.2%
	14.00	Count	19	12	35	11	77
		% within District	3.2%	4.8%	4.6%	4.7%	4.2%
	30.00	Count	27	8	37	4	76
		% within District	4.6%	3.2%	4.9%	1.7%	4.2%
	90.00	Count	23	7	18	9	57
		% within District	3.9%	2.8%	2.4%	3.9%	3.1%
	180.00	Count	12	3	5	3	23
		% within District	2.0%	1.2%	0.7%	1.3%	1.3%
	365.00	Count	2	3	12	5	22
		% within District	0.3%	1.2%	1.6%	2.2%	1.2%
Total		Count	590	249	753	232	1824
		% within District	100.0%	100.0%	100.0%	100.0%	100.0%

Source: SPSS version 27[63]

Using these cumulative percentages, it can be seen that most confirmed HIV+ patients records go on ART on the first day (71.3%), followed by those who started within the seven days (14.2%), with those who started after seven days and below 14 days being

at 4.2%. Also, those that started after 14 days but within 30 days constituted 4.2%, with those under such categorisations as 30, 90, 180, and 365 having 1.7%, 3.9%, 1.3% and 2.2%, respectively. The researcher saw it fit to run a cumulative analysis (by district) in Table 4.1 above, where delay/initiation time is described as either on, on-time or delayed.

4.2.1.2. ART Start Day (district cross-tabulation – cumulative percentages)

As a way of maintaining clarity on data presented in Table 4.2 below: day one describes those who started their ART on the first day (described as 'on'), seven days – those who started ART after one day but in less than seven days (described as 'on-time); 14 days – those who started ART after seven days but within a period not exceeding 14 days (described as 'delayed'); 30 days – confirmed HIV+ patients whose ART initiation took place after 14 days but not in more than 30 days (1 month); 90 days – confirmed HIV+ patients whose ART initiation happened after 30 days but not in more than 90 days (3 months); 180 days – those confirmed HIV+ patients who initiated the ART after 90 days but within a period not exceeding 180 days; and 365 days – confirmed HIV+ patients whose ART initiation commenced just after 180 days but within a period not exceeding 365 days

4.2.1.3. District cumulative percentage

In Table 4.2 below, it can be seen that Nyangana records had the most significant percentage of those who started during day one (75.9%), followed by Andara (72.2%), Oshikuku (71.4%) and lastly Tsumeb (67.7%) with a cumulative total of 71.8 for those who started on the first day. This finding, though with some minor differences, was in line with the results from a report by the Government of Namibia in 2013,

Table 4. 2: District cumulative percentage

		District* Cumulative Percent				
On	Start ART on Day:	Andara	Nyangana	Oshikku	Tsmb	Tot
	1 (Same Day)	72.2%	75.9%	71.4%	67.7%	71.8%
ON-TIME	7 (Week)	85.9%	86.7%	85.8%	86.2%	86.0%
DELAYD	14 (2 week)	89.2%	91.6%	90.4%	90.9%	90.2%
DELAYED	30 (1 month)	93.7%	94.8%	95.4%	92.7%	94.4%
	90 (3 months)	97.6%	97.6%	97.7%	96.6%	97.5%
	180 (6 months)	99.7%	98.8%	98.4%	97.8%	98.8%
	365 (Year)	100%	100.0%	100.0%	100%	100%

Source: SPSS version 27[63]

which stated that, although one's decision on when to start the ART program relies on the district they are from, there have been several instances when the ART start date depends on other factors and not the district.[13]

4.2.1.4. Cumulative percentage – trend for district start dates

Shown in Figure 4.4 below is the trend for the cumulative percentages shown by district, where it is showing that the Nyangana district records has got high number patients who start on the first day, and Tsumeb has got the least (67.7%). Andara and Oshikuku both have considerably higher percentages on the first day 72.2% and 71.4%, respectively.

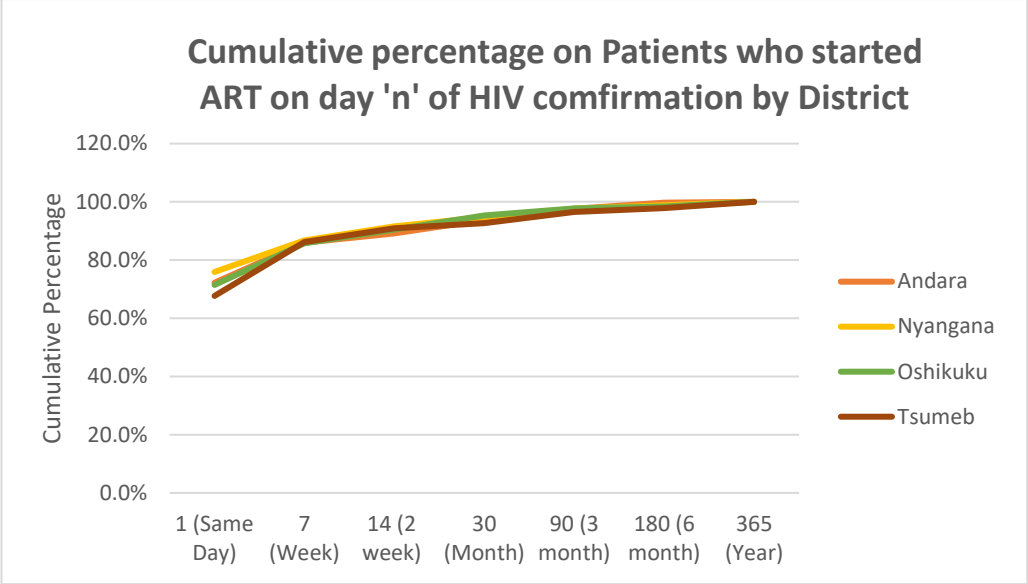

Figure 4.1: Cumulative percentage started ART on day 'n' of HIV confirmation by District

Source: SPSS version 27[63]

As illustrated in Figure 4.1 above, for Andara, Nyangana, Oshikuku and Tsumeb records: those who started in a period of 7-14 days were 13.7%, 10.8%, 14.3% and 18.5%, respectively; those whose ART initiation process commenced in the 14-30 day period were: 3.2%, 4.8%, 4.6% and 4.7% respectively; confirmed HIV+ patients who started ART during the 30-90 period were 4.6%, 3.2%, 3.9% and 4.7% respectively; the percentage frequencies of those taking ART in the 90-180 day period were 3.9%, 2.8%, 2.4% and 3.1% respectively; and also those who started ART in 180 – 365 days were 2%, 1.2%, 0.7% and 1.3% respectively**.**

4.2.1.5 The pattern of timing Trend of ART delay by month

Figure 4.2 below shows the number of confirmed HIV+ patients records who started ART on HIV confirmation. In July 2017, most confirmed HIV+ patients started ART on the same day of confirmation, as shown by the 65.6%. The same trend was maintained (31 July 2017 to 30 June 2018). Thus, most confirmed HIV+ patients started ART the same day after confirming that they were HIV+. March 2018 had the

highest figures (86.3%) of confirmed HIV+ patients who started ART the same day of confirming that they were diagnosed HIV+, followed by June 2018 (80.3%) and February 2018 (79.1%).

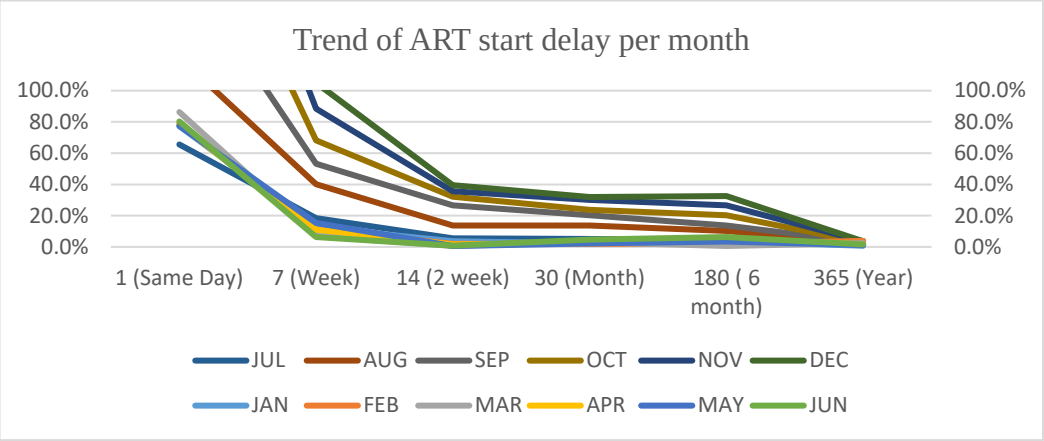

Figure 4. 1: Trend of ART delay per month

Source: SPSS version 27[63]

The confirmed HIV+ patients records who started ART the seven days of confirming that they were HIV+ followed those who started ART on the same day of HIV confirmation. August 2017 had the highest figure (21.8%), followed by November 2017 (20.4%) and July 2017 (18.3%). Therefore, it can be seen that the majority of the confirmed HIV+ patients did not delay starting their ART after HIV confirmation. The least of the patients delayed to start ART after confirmation of HIV status are spread over the year. Hence, the reason for the same graph is descending from left to right as we move closer to 365 days.

4.2.2 Objective two: Identifying and describing the Characteristics of confirmed HIV+ individuals records delayed in the start of ART in the four UTAP districts records of Andara, Nyangana, Oshikuku and Tsumeb.

This objective deals with features of confirmed HIV+ people's records who experience a delay in the start of ART deriving the data from information provided for the four districts that the study is investigating Andara, Nyangana, Oshikuku and Tsumeb records.

4.2.2.1. CD4 count records as a factor behind ART uptake (WHO-stage cross-tabulation)

The study sought to identify and describe the characteristics of confirmed HIV+ individuals who are delayed in the start of ART. Thus, the study looked at the characteristics of delaying ART's start, CD4 count, and the WHO stage. As highlighted in chapter 1, the study considered 4 stages of WHO-stage that is, stage I, stage II, stage III and stage IV. The study found that, the majority (85.8%) of confirmed HIV+ patients who were in WHO-stage 1 and having CD4 count between 300-399 cells/mL; 400-499 cells/mL; 500-599 cells/mL; 600-699 cells/mL; and 700-799 cells/mL did not delay the start of ART. In WHO-stage 2, most (86%) of the confirmed HIV+ patients having CD4 between 100-199 cells/mL and 200-299 cells/mL did not delay the start of ART, as shown in Table 4.4 below.

Patients in WHO-stage 3 showed a similar trend. The majority of the confirmed HIV+ patients having CD4<100 cells/mL and between 100-199 cells/mL did not delay the start of ART. The same was observed in patients who were in WHO-stage IV. Most (93.8%) of them had CD4<100 cells/mL and between 100 and 199 cells/mL did not

delay the start of ART. The trend is apparent regarding the information provided by Table 4.3 below, as it reflects the fact that the higher the CD4 count, the more likely it is that the HIV positive person will start the ART program late.

Table 4.3: Delay as a product of CD4 count and WHO-stage records

Cross tabulation

delay * CD4 count * whostage Crosstabulation

whostage				CD								Total
				< 100.00	100.00 - 199.00	200.00 - 299.00	300.00 - 399.00	400.00 - 499.00	500.00 - 599.00	600.00 - 699.00	700.00 - 799.00	
1.00	delay	No	Count				206	1022	116	1	1	1346
			% within CD				88.4%	85.1%	87.2%	100.0%	100.0%	85.8%
		yes	Count				27	179	17	0	0	223
			% within CD				11.6%	14.9%	12.8%	0.0%	0.0%	14.2%
	Total		Count				233	1201	133	1	1	1569
			% within CD				100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2.00	delay	No	Count		70	84						154
			% within CD		77.8%	94.4%						86.0%
		yes	Count		20	5						25
			% within CD		22.2%	5.6%						14.0%
	Total		Count		90	89						179
			% within CD		100.0%	100.0%						100.0%
3.00	delay	No	Count	31	19							50
			% within CD	81.6%	86.4%							83.3%
		yes	Count	7	3							10
			% within CD	18.4%	13.6%							16.7%
	Total		Count	38	22							60
			% within CD	100.0%	100.0%							100.0%
4.00	delay	No	Count	12	3							15
			% within CD	92.3%	100.0%							93.8%
		yes	Count	1	0							1
			% within CD	7.7%	0.0%							6.3%
	Total		Count	13	3							16
			% within CD	100.0%	100.0%							100.0%
Total	delay	No	Count	43	92	84	206	1022	116	1	1	1565
			% within CD	84.3%	80.0%	94.4%	88.4%	85.1%	87.2%	100.0%	100.0%	85.8%
		yes	Count	8	23	5	27	179	17	0	0	259
			% within CD	15.7%	20.0%	5.6%	11.6%	14.9%	12.8%	0.0%	0.0%	14.2%
	Total		Count	51	115	89	233	1201	133	1	1	1824
			% within CD	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: SPSS version 27[63]

This finding is confirmed by Craigie and Bushman in their 2011 study where it was revealed that those with a low CD4 count are likely to start the ART the same day, regardless of the WHO-stage.[15]

4.2.3 Objective three: Determining demographic, clinical and health service factors associated with delay in the start of ART in the four UTAP districts.

4.2.3.1 Gender as a factor in ART start delay

Table 4.4: Trend of ART delay per month_delay * Gender Cross-tabulation

			Gender		
			male	Female	Total
delay	No	Count	569	996	1565
		% within Gender	82.0%	88.1%	85.8%
	Yes	Count	125	134	259
		% within Gender	18.0%	11.9%	14.2%
Total		Count	694	1130	1824
		% within Gender	100.0%	100.0%	100.0%

Source: SPSS version 27[63]

Under this variable, the researcher wanted to establish the impact that sex (gender) has on ART start delay, and that is why a cross-tabulation of male and female data was conducted in Table 4.4 above.

The study looked at the gender characteristics of the confirmed HIV+ patients records about the delay to start ART after confirmation of HIV+ status. The study showed that females were more responsive to start ART soon after confirming HIV+, as shown in Table 4.4 above. Thus, 88.1% of the females started ART, and 11.9% delayed starting ART. On the other hand, male patients were also responsive in starting ART after confirmation of having HIV+, as shown by 82% (majority) who did not delay the start of ART. However, 18% of the males delayed the start of ART after confirmation that they had HIV infection.

The study showed that most of the confirmed HIV+ patient records included in the research were female, represented by 62%, as shown in figure 4.3 below. The minority

of the confirmed HIV+ patient records included in the research were males (38%). This finding of females having to start the ART earlier than their male counterparts concurs with Mahon C, (2017)'s,[48] study which found that females usually embark on ART earlier because of various factors than their male counterparts.

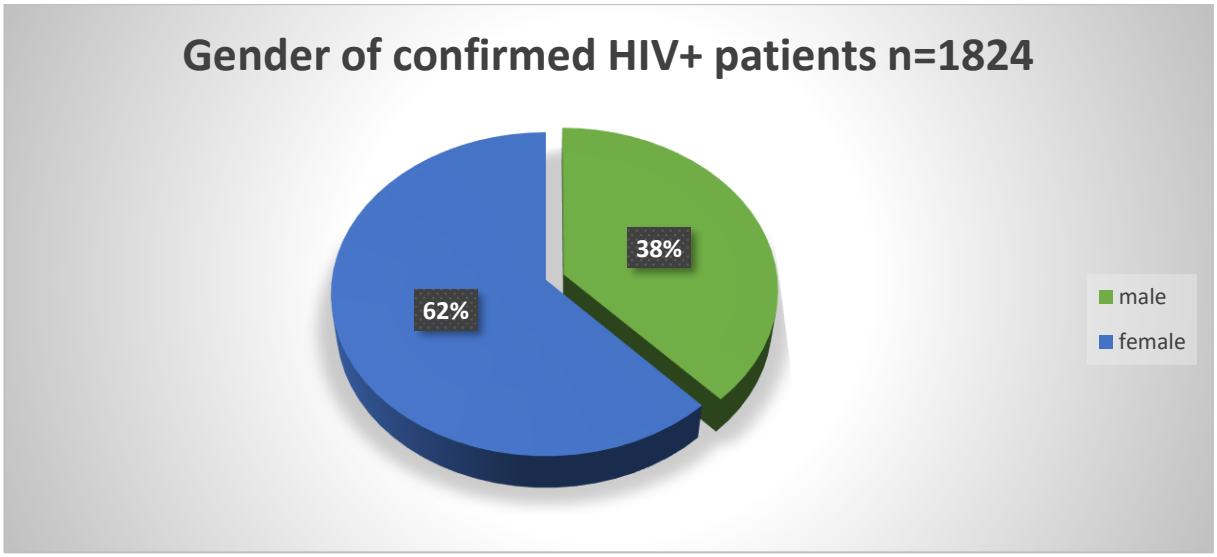

Figure 4. 2: Gender of confirmed HIV+ patients

Source: SPSS version 27[63]

4.2.3.2 Trend of the cumulative percentage of confirmed HIV+ patients records starting on the first day of confirmation by facility type

Figure 4.4 below shows the trend of the cumulative percent of confirmed HIV+ patients records who started ART on the day of confirmation within the three facility types i.e., Clinic, Health Centre and Hospital. The majority (86%) of the confirmed HIV+ patients started ART on time in all different facilities. Therefore, the Hospital facility had the most confirmed HIV+ patients who started ART on the day of HIV confirmation. The minority of the confirmed HIV+ patients delayed the start of ART

across all three facility types. Thus, the Health centre had the most confirmed HIV+ patients who delayed starting ART upon HIV confirmation.

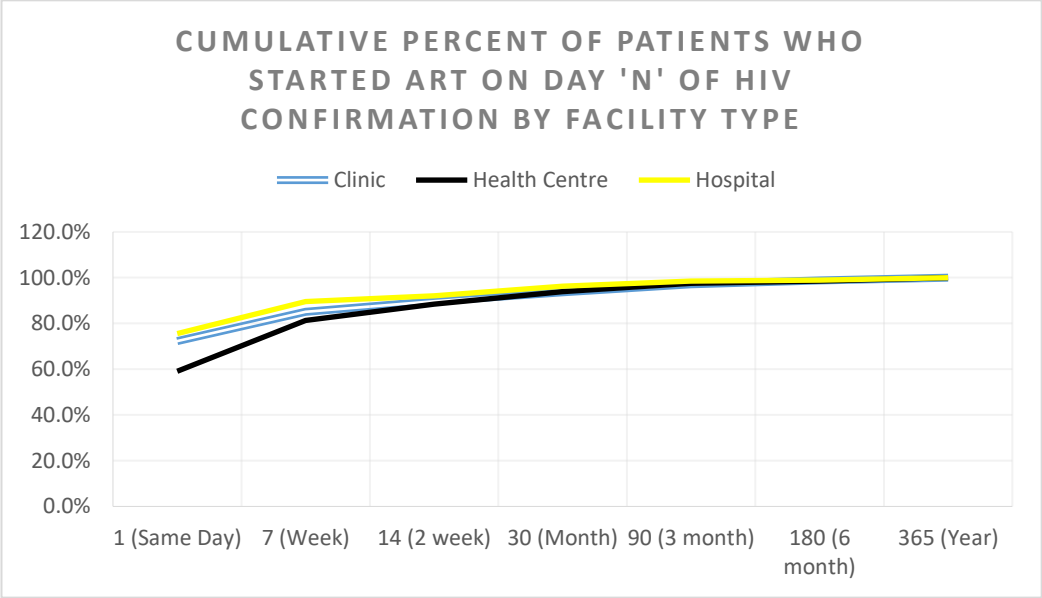

Figure 4. 4: Trend of the cumulative percentage of confirmed HIV+ patients starting ART by service delivery

Source: SPSS Version 27[63]

4.2.3.3 ART Start Day –by day 7 and onwards, by the facility type cross-tabulation

Table 4.5 below shows the ART start-day within the three different facilities: Clinic, Health centre, and Hospital. The results showed that most confirmed HIV+ patients records (89.6%) who were on time to start ART were from Hospital facilities, followed by Clinic facilities with 85.1% and lastly, Health centre facilities with 81.3%. The confirmed HIV+ patients who delayed to start ART by two weeks were mainly from Health centre facilities (7.1%) followed by Clinic facilities (4.6%) and Hospital facilities with 2.4%. The same trend was seen with confirmed HIV+ patients who delayed to start ART by one month were mostly from Health centre facilities (5.6%),

Table 4. 5: ART start day by facility (cross-tabulation).

ART_start_Day_group * Facility Type Crosstabulation									
			Facility Type						
			Clinic	Cumulative	Health Centre	Cumulative	Hospital	Cumulative	Total
ART_start_Day_group	1.00	Count	785	785	117	117	408	408	1310
		% within Facility Type	72.3%	72.3%	59.1%	59.1%	75.6%	75.6%	71.8%
	7.00	Count	139	924	44	161	76	484	259
		% within Facility Type	12.8%	85.1%	22.2%	81.3%	14.1%	89.6%	14.2%
	14.00	Count	50	974	14	175	13	497	77
		% within Facility Type	4.6%	89.7%	7.1%	88.4%	2.4%	92.0%	4.2%
	30.00	Count	42	1016	11	186	23	520	76
		% within Facility Type	3.9%	93.6%	5.6%	93.9%	4.3%	96.3%	4.2%
	90.00	Count	38	1054	7	193	12	532	57
		% within Facility Type	3.5%	97.1%	3.5%	97.5%	2.2%	98.5%	3.1%
	180.00	Count	19	1073	2	195	2	534	23
		% within Facility Type	1.7%	98.8%	1.0%	98.5%	0.4%	98.9%	1.3%
	365.00	Count	13	1086	3	198	6	540	22
		% within Facility Type	1.2%	100.0%	1.5%	100.0%	1.1%	100.0%	1.2%
Total		Count	1086	6912	198	1225	540	3515	1824

Source: SPSS version 27[63]

followed by Hospital facilities with 4.3% and Clinic facilities with 3.9%. In their study conducted in 2019, AVERT found out that, on matters of the timing of the ART uptake, the type of healthcare facility matters as hospital facilities are known to attract early ART uptakes compared to other facilities, [12] and this statement is confirmed by the study's finding on the same mater.

The confirmed HIV+ patients who delayed to start ART by 90 days (as shown in Table 4.5 above) were mainly from Health centre facilities and Clinic facilities. However, for confirmed HIV+ patients who delayed to start ART by 180 days, the majority were from Clinic facilities followed by Health centre facilities (1%) and Hospital facilities (0.4%). Furthermore, confirmed HIV+ patients who delayed to start ART by 365 days were mostly from Health centre facilities (1.5%), followed by Clinic facilities (1.2%) and Hospital facilities (1.1%).

4.3. The Logit /multi-variate regression model[78]

The researcher developed the logistic regression model to fulfil objective number three, which had categorical data in age, district, and facility.

4.3.1. Objective three: Demographic, clinical and health service factors associated with delay in the start of ART in the four UTAP districts.

4.3.1.1. Model assumptions[78]

Chapter three highlights that the multi-variate logistic regression should meet the model's assumptions. Therefore, the following assumptions were checked before the model was run, and the dependent variable was found to be measured on a

dichotomous scale (delay in starting ART – 'Yes' or "No'). The study employs one or more independent variables that were continuous or categorical (in our case, the study used three categorical and four continuous variables). Lastly, the model had independent variables, and the outcome variable had mutually exclusive and exhaustive categories.

Table 4. 1: Correlation Analysis[63]

Correlations

		Delay	Gender	Who-stage	Age	District	Facility	CD	VL
Delay	Pearson Correlation	1	-.086	-.004	-.006	.007	-.048	.001	.002
Gender	Pearson Correlation	-.086	1	-.010	-.151	.008	-.029	.090	-.058
Who-stage	Pearson Correlation	-.004	-.010	1	.034	-.071	.062	-.485	.464
Age	Pearson Correlation	-.006	-.151	.034	1	.140	-.018	-.009	.001
District	Pearson Correlation	.007	.008	-.071	.140	1	-.046	.105	.000
Facility	Pearson Correlation	-.048	-.029	.062	-.018	-.046	1	-.043	.064
CD	Pearson Correlation	.001	.090	-.485	-.009	.105	-.043	1	-.427
VL	Pearson Correlation	.002	-.058	.464	.001	.000	.064	-.42	1

4.3.1.2. Model fitness test

Before the model was run, correlation analysis was done to check if the independent variables in the model had associations. Table 4.6 shows the results from the correlation analysis between the dependent and independent variables. The results

show that the dependent and the independent variables are not correlated, as shown by values less than ±0.5. Therefore, the data was deemed reliable for the logistic regression model.

Another test used to check model fitness was the Omnibus test of model coefficients. This is shown in table 4.7 below:

Table 4. 2: Omnibus tests of model coefficients[63]

Omnibus Tests of Model Coefficients

		Chi-square	Df	Sig.
Step 1	Step	29.383	10	.001
	Block	29.383	10	.001
	Model	29.383	10	.001

Source: SPSS version 27[63]

Table 4. 3: Pseudo R-squared

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	1460.772[a]	.210	.321

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.

Source: SPSS version 27[63]

The Omnibus test of model coefficients is one of the model fitness tests for the Logit regression model. The results show that, the overall model is statistically significant, Chi-square (10) = 29383, p<0.05 = 0.001.

The model fitness can also be assessed through the pseudo-r-squared, which are shown in table 4.8 aboveThe table encompasses the R Square values for Cox & Snell and Nagelkerke, both methods for computing the explained variability. As a result, our model explains between 21.0 and 32.0 percent of the variation in the dependent variable.

Another fitness test is the Hosmer and Lemeshow Test. The Hosmer-Lemeshow test is used to determine whether the model's predictions perfectly match identified group memberships.

Table 4. 4: Hosmer and Lemeshow test

Hosmer and Lemeshow Test

Step	Chi-square	Df	Sig.
1	1.452	8	.793

Source: SPSS version 27[63]

A chi-square statistics are calculated to compare observed and expected frequencies under the linear model. A chi-square value that is not significant implies that the data fit the model well. As p=0.793 is greater than.05, the model fits the data well.

4.3.1.3 Model explanation

The model had 1824 cases that were included in the analysis. There were no missing cases.

Table 4. 5: Case processing summary

Case Processing Summary

Unweighted Cases[a]		N	Percent
Selected Cases	Included in Analysis	1824	100.0
	Missing Cases	0	0
	Total	1824	100.0
Unselected Cases		0	.0
Total		1824	100.0

a. If weight is in effect, see classification table for the total number of cases.

Source: SPSS version 27[63]

Table 4. 6: Dependent variable encoding

Dependent Variable Encoding

Original Value	Internal Value
No	0
Yes	1

Source: SPSS version 27

The dependent variables were coded as follows: 0 – 'No Delay' represented by 'No'; and 1 – 'Delay' represented by 'Yes'.

The categorical variables shown in Table 4.12 (model) below did include; district (Andara, Nyangana, Oshikuku and Tsumeb), facility (clinic, health-care and hospital) and gender. (male and female).

Table 4. 7: Categorical variable coding

Categorical Variables Coding

			Parameter coding		
		Frequency	(1)	(2)	(3)
District	ANDARA	586	1.000	.000	.000
	NYANGANA	248	.000	1.000	.000
	OSHIKUKU	753	.000	.000	1.000
	TSUMEB	237	.000	.000	.000
Facility	CLINIC	1107	1.000	.000	
	HEALTH CENTRE	175	.000	1.000	
	HOSPITAL	542	.000	.000	
Gender	Male	697	1.000		
	Female	1129	.000		

Source: SPSS version 27[63]

Table 4. 8: The classification table (constant, cut value)

Classification Table[a,b]

Step 0	Delay	No	1564	0	100.0
		Yes	260	0	.0
	Overall Percentage				85.8

a. Constant is included in the model.

b. The cut value is .500

Source: SPSS version 27[63]

The classification table (ab – from Block 0) formed the model's baseline and compared it with the classification model a in Block 1. Based on the overall percentage of 85.8%, the model can be described as having a correct prediction.

Table 4. 9: Variables in the equation

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	-1.798	.067	718.478	1	.000	.166

Source: SPSS version 27

Table 4. 10: Model prediction - observed v delay

Observed		Predicted		
		Delay		Percentage
		No	Yes	Correct
Delay	No	1420	144	90.8
	yes	58	202	77.6
Overall Percentage				88.9

Source: SPSS version 27[63]

The model now accurately classifies the result in 88.9% of cases, up from 85.8% in the null model (classification table ab), a significant improvement. Additionally, the outcomes indicate that the model predicted 77.6 % of confirmed HIV+ patients who delayed initiating ART to have delayed initiating ART after confirming their status (HIV+). The results also show that 90.8% of HIV+ patients who did not delay (on time) in the starting of the ART were correctly predicted by the model not to have delayed the starting of the ART after the confirmation of the HIV+ status.

Thus, of all cases having been predicated as having delayed the uptake of ART, 58.3% were correctly predicted. Furthermore, of all cases predicted as not having delayed the ART uptake, 96.1% were predicted correctly.

From table 4.16 below, the results showed that of the seven independent variables included in the model, only four were statistically significant. Gender (p=0.000); age (p=0.002), facility (p=0.001), and CD4 (p=0.038) were significant since p was less than 5%. Hence, these variables help explain the delay in starting ART by confirmed HIV+ patients after confirming their HIV+ status. Thus, table 4.16 shows that the odds

Table 4. 11: The equation's variables (table block 1)

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
Step 1[a]	Gender(1)	.547	.139	15.485	1	.000	1.727	1.316	2.268
	Who stage	-.243	.362	.449	1	.503	.785	.386	1.595
	Age	.305	.135	11.798	1	.002	1.595	1.385	2.190
	District			.885	3	.102			
	District(1)	.036	.223	.826	1	.110	1.037	.670	1.605
	District(2)	.021	.268	.706	1	.189	1.021	.604	1.728
	District(3)	-.021	.226	.869	1	.147	.979	.629	1.525
	Facility			14.825	2	.001			
	Facility(1)	.419	.167	6.306	1	.012	1.521	1.096	2.109
	Facility(2)	.928	.247	14.072	1	.000	2.528	1.557	4.105
	CD4	.812	2.81	3.527	1	.038	1.214	.997	1.698
	VL	.000	.000	.287	1	.192	1.000	1.000	1.000
	Constant	1.686	1.252	1.815	1	.178	.185		

a. Variable(s) entered on step 1: Gender, who stage, age, District, Facility, CD, VL.

Source: SPSS version 27[63]

of delaying the start of ART by confirmed HIV+ patients is 1.727 greater for males than females after confirming the HIV+ status. Also, increasing age was associated with an increased likelihood of delaying the start of ART after confirming HIV+ status, as established by AVERT's 2019 study.[29]

Furthermore, increasing the CD4 count of the confirmed HIV+ patient was associated with an increased likelihood of delaying the start of ART after confirming HIV+ status. The results showed that the odds of delaying the start of ART by confirmed HIV+ patients was 2.528 greater for facility 2 (Health Centre) patients as opposed to patients in facility 1 (Clinics), agreeing with the findings of WHO in 2007, which

revealed the existence of a positive correlation between CD4 count and delay in the start of ART.[29]

4.4 Results and Discussion

The study's main task was to fulfil the objectives mentioned above, and after going through the process, the following findings emerged:

The "Variables in the equation" model in Table 4.16 revealed that only four of the seven independent variables were statistically significant. Gender (p=0.000), age (p=0.002), facility (p=0.001), and CD4 count (p=0.038) were all significant. These variables help explain why confirmed HIV+ patients delay initiating ART after being diagnosed.

4.4.1. Objective one: Proportion of delay in the start of ART in the four UTAP districts.

This objective examined how many confirmed HIV+ patients started anti-retroviral medication on confirmation. Most confirmed HIV+ patients (86%) started ART on time in all facilities. A substantial proportion of confirmed HIV+ patients started ART upon HIV confirmation at the hospitals. A minority of confirmed HIV+ patients delayed starting ART. As a result, the Health Center had the most significant proportion of confirmed HIV+ patients delaying starting ART. In July 2017, 65.6% of confirmed HIV+ individuals started ART the same day they were diagnosed. A similar pattern was observed over time (31 July 2017 to 30 June 2018). Thus, most confirmed HIV+ individuals started ART the day they were diagnosed. The highest rate of confirmed HIV+ patients starting ART on the same day was in March 2018 (86.3%), followed by June 2018 (80.3%) and February 2018 (80.3%). (79.1 percent).

4.4.2. Objective two: Characteristics of HIV positive individuals who are delayed in the start of ART in the four UTAP districts.

ART Start Day by District.

It can be determined that Nyangana had the highest percentage of those who began on day one (75.9%), followed by Andara (72.2%), Oshikuku (71.4%), and Tsumeb (67.7%), for a cumulative total of 71.8 percent of those who began on day one. In general, a significantly higher proportion (71.8%) of confirmed HIV+ patients initiated ART on the first day following confirmation of their HIV+ status in all four UTAT districts. For Andara, Nyangana, Oshikuku and Tsumeb: those who started in a period of 7-14 days were 13.7%, 10.8%, 14.3% and 18.5%, respectively; those whose ART initiation process commenced in the 14-30 day period were: 3.2%, 4.8%, 4.6% and 4.7% respectively; confirmed HIV+ patients who started ART during the 30-90 period were 4.6%, 3.2%, 3.9% and 4.7% respectively; the percentage frequencies of those taking ART in the 90-180 day period were 3.9%, 2.8%, 2.4% and 3.1% respectively; and also those who started ART in 180 – 365 days were 2%, 1.2%, 0.7% and 1.3% respectively.

CD4 count and ART start day

The majority (85.8%) of confirmed HIV+ patients in WHO-stage I with CD4 levels between 300-399 cells/mL, 400-499 cells/mL, 500-599 cells/mL, 600-699 cells/mL, and 700-799 cells/mL did not delay ART initiation. In WHO-stage II, most (86%) HIV+ patients with CD4 between 100-199 cells/mL and 200-299 cells/mL started ART immediately. The majority of confirmed HIV+ patients with CD4>100 cells/mL and between 100 and 199 cells/mL did not postpone starting ART. The majority

(93.8%) of patients with CD4>100 cells/mL and between 100 and 199 cells/mL did not postpone ART commencement. Increasing the CD4 count level of the confirmed HIV+ patient also enhanced the likelihood of postponing ART start after HIV confirmation within the model in Table 4.16.

4.4.3. Objective three: Demographic, clinical and health service factors associated with delay in the start of ART in the four UTAP districts.

Gender

According to the study, most confirmed HIV+ patients included in the study were female, accounting for 62% of the total. Males made up a small percentage of the confirmed HIV+ patients included in the study (38 percent). Table 4.13 demonstrates that after confirming HIV+ status, males are 1.727 more likely than females to delay starting ART.

Also, older age groups were more likely to delay starting ART after confirming HIV+ diagnosis.

The classification table (ab) from Block 0 was utilized to compare the model to the classification model in Block 1. The overall prediction accuracy of the model is 85.8%. The model summary table includes Cox & Snell and Nagelkerke R Square values. The researcher's model explained between 21.0 and 32.0 percent of the dependent variable's variation. In the Hosmer and Lemeshow test, a non-significant chi-square value indicates that the data fit the model well, and p=0.793 is greater than.05.

The model now correctly identifies the result in 88% of cases, compared to 88% with the null model (classification table ab). The model also projected that 77.6% of confirmed HIV+ individuals who delayed starting ART would do so after being

confirmed as HIV+. The model correctly predicted 90.8 percent of confirmed HIV+ individuals who did not postpone (on time) commencing ART.

The "Variables in the equation" model revealed that only four of the seven independent variables were statistically significant. Gender (p=0.000), age (p=0.002), facility (p=0.001), and CD4 count (p=0.038) were all significant. These variables help explain why confirmed HIV+ patients delay initiating ART after being diagnosed. Table 4.16 demonstrates that after confirming HIV+ status, males are 1.727 more likely than females to delay starting ART.

Also, older age groups were more likely to delay starting ART after confirming HIV+ diagnosis. Increasing the CD4 count level of the confirmed HIV+ patient also enhanced the likelihood of postponing ART start after HIV confirmation.

ART Start Date by Facility Type

The study illustrates the ART start day at the Clinic, Health Center, and Hospital. The data showed that confirmed HIV+ patients in facility 2 (Health Centre) were 2.528 more likely than those in facility 1 to delay starting ART (Clinics) after the confirmed HIV+ status is confirmed.

Most confirmed HIV+ patients (89.6%) who started ART on time were from hospitals, followed by clinics (85.1%) and health centres (81.3%). The confirmed HIV+ patients who started ART two weeks late were predominantly from Health Centres (7.1%), Clinics (4.6%), and Hospitals (2.4%). confirmed HIV+ patients who delayed starting ART by one month were predominantly from Health Centres (5.6%), followed by Hospitals (4.3%) and Clinics (3.9%).

4.5 Chapter summary

In this chapter, the researcher analyzed secondary data gathered from the MoHSS national level ePMS, and this data covered four high HIV burdened public health facilities in the districts of Andara, Nyangana, Oshikuku and Tsumeb. Also in Northern Namibia. The researcher discussed the results (findings) from the analysis. To attain this, the researcher addressed the following: descriptives and the logit regression model with such sub-categories as mode assumptions, case processing summary, dependent variable encoding, categorical variable coding, the classification table, variables in the equation, the model summary, the Hosmer and Lemeshow test, model prediction, as well as variables in the equation.

CHAPTER FIVE

CONCLUSIONS, IMPLICATIONS OF THE STUDY AND RECOMMENDATIONS

5.1. Introduction

The study, has been a journey that started at the literature review followed by the research methodology, the analysis and discussion stages of the research process, that affords the reader a considerable understanding of the subject under discussion that was, in a nutshell, captured. Chapter Five's prerogative is to reach at conclusions, outline implications of the study and make recommendations from the leassons learnt.

5.2. The Study's Purpose

The study examined factors that are behind the delay in the starting of ARV treatment by confirmed HIV+ patients records, from of four UTAP HIV high burdened districts public facilities of Andara, Nyangana, Oshikuku, and Tsumeb in Northern Namibia. This purpose, however, could only be fulfilled after working on the following specific objectives:

1. Estimating the proportion of delay in the start of ART in the four UTAP districts;
2. Identifying and describing the characteristics of confirmed HIV positive individuals who are delayed in the start of ART in the four UTAP districts; and
3. Determining demographic, clinical and health service factors associated with delay in the start of ART in the four UTAP districts.

5.3. Conclusions

Having computed the findings, the researcher can draw the following conclusions from the study. Quite a bigger percentage of confirmed HIV+ patients started ART on the day of HIV confirmation at the hospitals. A minority of confirmed HIV+ patients delayed starting ART, with the Health Center having the largest proportion of confirmed HIV+ patients delaying to start ART. Compared to their male counterparts, females dominated the investigation. Nyangana district had the biggest percentage of those who partook of the ART during the first day of confirmation. The majority of those who started ART during the first day did so from the hospital, followed by those from the clinics and followed by those from the health centre. Majority (85.8%) of confirmed HIV+ patients who were in WHO-stage 1 and having CD4 count between 300-399 cells/mL; 400-499 cells/mL; 500-599 cells/mL; 600-699 cells/mL; and 700-799 cells/mL did not delay the start of ART. In WHO-stage 2, most (86%) of the HIV+ patients having CD4 between 100-199 cells/mL and 200-299 cells/mL did not delay the start of ART. The regression model showed that the following variables were stastically significant: gender, age, CD4+ count and Facility 2 ($p \leq 0.05$). The rest of the variables are insignificant as their p values are > 0.05.

5.4. Implications of the study

The study has some implications to theory, practice and management, as discussed below:

5.4.1. Implications on theory

Some theoretical perspectives were studied on the factors associated with the delay in the start of ART. This theoretical analysis positioned the researcher to think about the date (time) of starting the ART from the viewpoint of the number of days one takes to

start the treatment, compared to the day they could have confirmed their HIV+ status. The causative factors (inputs criteria) are seen as having a bearing on when one has to start taking ART, and these input criteria included demographic, clinical and health service factors. Since it remains unclear to identify the influence of such factors on the delay of ART initiation, the researcher utilised the logistic regression model to describe findings clearly. Findings from this investigation describe how various factors specified in this study impact one's (confirmed HIV+ patient's) choice of the date on which to start taking ART.

5.4.2. Implications on practice

To the management and cadres rendering health care services in the various health facilities from the four UTAP districts under consideration, the study offers some recommendations, which they should implement to come out with quality ART programs. To the field of academics, the study will, as a pilot analysis, contribute to the body of knowledge, especially in areas of health and clinical sciences. Therefore, future researchers and university libraries might rely on this piece of work to develop their knowledge bases.

5.4.3. Implications on policy

The study might help the Namibian policy-makers, Community partners, HIV Testing and Treatment departments with ideas on initiatives that the state can employ in its eforts to scale up enlightening/educating of citizens on the significance of starting taking ART as early as same day and up to seven days after being confirmed living with HIV, as this reduces viral loads, the frequencies of passing on the infection and AIDS-related deaths, towards the achievement of epidemic control in Namibia.

5.5. Recommendations

In light of the problem being investigated in this study, the issue of the delay in the start of ART, the researcher has, therefore, decided to come out with the following recommendations:

i. The most commonly cited driver of ART uptake at the societal level is the existence of well crafted literature for educating Health Care workers to then educate the patients on the new found knowledge and importance of starting ART on the same day that one is confirmed living with the HIV.

ii. Strengthen the capacity of service providers inservice, to enhance their knowledge and catch up with emerging evidence and practices – Continuous Professional Development through HIV Clinical Mentorship, including Training and periodical supervision including through online in-service conference calls

iii. Funding from the line Ministry and the Donor agencies is required for the inservice training to take place, development of training materials, to be created in the languages of the 14 regions of Namibia by the Treatment Technical Working Group and

iv. to be disseminated at all ART clinics to group settings and individually to the recipients of ART daily by the Health Assistants, Nurses, Pharmacists and Doctors at all the service points including in the community by the various community partners

v. Training is aimed at enlightening people testing positive to HIV the new knowledge that starting early and attaing viral load suppression and continuing with treatment restores the immunity system ability to wade off opportunistic infections whilst stopping onward passing of the infection that contributes to

living a healthy life and towards the attainement of epidemic control for Namibia and globally, treatment being taken as prevention. [11]

vi. Forstering models of champions from amongst PLWHIV, especially for men who are bound to delay, the messaging should be delivered by other men living with HIV, to counsel and encourage men to start same day ART

vii. Enhanced counseling to be given at the facility or outreach points at the time of HIV testing and subsequently, which ensures that the confirmed HIV+ patients accesses the ART in time.[9]

viii. The cost-effectiveness of various ART delivery systems, such as Direct Service Delivery models and more robust community based support programs, also leads to the ART 's early uptake.

ix. By making ART services more physically accessible, through outreach services, it is possible to generate a relative rise in early ART uptake.[45]

x. Compliance with the procurement, supply, and dispensing chains from the country's budget allocation from the Ministry of Finance, by Central Medical Stores pharmaceutical buyers, Regional pharmacists that place the orders, down to the district pharmacist level who makes orders and lastly to the facility level where stock cards are to be kept and updated with orders being placed on time, is necessary to avert medicine stock outs and ensure that ART are accessible as needed as the demand increases.[34]

xi. Relaxing policy to permit concurrent counselling and medication administration, the integration of services, rather than segregating the two procedures that makes room for the client to be sent around the facility to get services resulting in them opting to come another day, may facilitate early ART initiation.[14]

xii. Decentralization of antiretroviral therapy and other HIV-related services to areas in greater need also is a solution to the delay problem. At a distance only 5 kilometres from the nearest health facility, persons living with HIV chances of getting ART are less than half those of a person residing directly adjacent to a health institution, all other factors being equal.[33]

xiii. Also, the MoHSS should equip all healthcare centres regardless of their types and size equitably, so that confirmed HIV+ patients get access to adequate care and counselling (and other related services) on time and therefore without delay.[42]

5.6. Limitations of the study

Secondary data that the study had access to appeared vague and general and would probably not help the Health Care workers and the management of the public facilities of the four selected UTAP districts (Andara, Nyangana, Oshikuku, and Tsumeb) in the making of strategic, tactical and operational decisions. To counter this, the researcher carefully selected variables that would better predict the outcomes, including age, gender, facility type and CD4+ count, among others. Again, the sample used to generate secondary data (1832) appeared too small and from only four (4) districts out of Namibia's 14 regions. However, the researcher planned for the desired accuracy through the pilot survey conducted to represent the whole population. The ePMS data completeness depends on the whole facility's staff ability and diligence to do so, as incomplete records in the PCBs result in incomomplete data being inputted into the data base and hence variables were often incomplete in the facility master lists.

5.7. Suggestions for future research

The study's main goal was to examine the impact of demographic, clinical and health service factors on the delay in the start of the ART amongst confirmed HIV+ patients. However, the researcher recommends that future research also look at other important variables like socio-economic patterns and their contribution to the time of ART uptake and the HRH factors especially the staffing norms as staff shortages are a known factor in causing delays through systematic scheduling of services to allow for the few staff to all services over the period of a week. Again, the study is of a desktop (secondary) nature and might be subjected to biases and other shortfalls of initial investigations that can also be outdated. Therefore, it is highly recommended that future studies also conduct primary research that is authentic, reliable, and up-to-date. As alluded to in the limitations to the desktop study, the ePMS uses routinely collected ART patient data. Behavioural and other health system data (other than facility type, which is included in this study are not routinely obtainable and were beyond the scope of this study for future studies human resources for health could be included together with assessment of behavioural as it is not known if it is the way heath centres function that is impeding test and treat and health system factors associated with delays in starting treatment could then be made.

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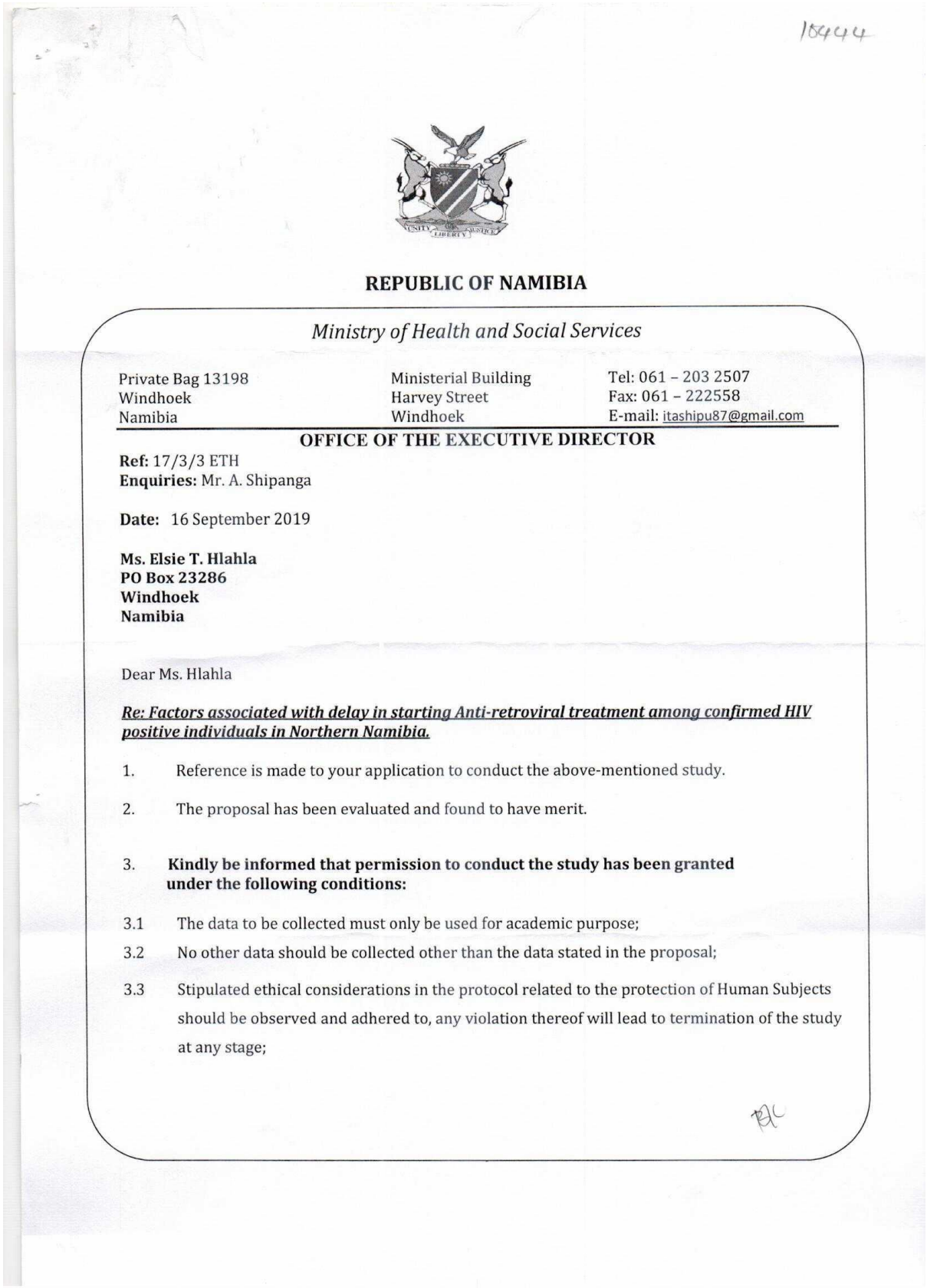
APPENDICES

Annexure C: Permission letter from the MoHSS



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REPUBLIC OF NAMIBIA

Ministry of Health and Social Services

Private Bag 13198
Windhoek
Namibia

Ministerial Building
Harvey Street
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Tel: 061 – 203 2507
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OFFICE OF THE EXECUTIVE DIRECTOR

Ref: 17/3/3 ETH
Enquiries: Mr. A. Shipanga

Date: 16 September 2019

Ms. Elsie T. Hlahla
PO Box 23286
Windhoek
Namibia

Dear Ms. Hlahla

Re: Factors associated with delay in starting Anti-retroviral treatment among confirmed HIV positive individuals in Northern Namibia.

1. Reference is made to your application to conduct the above-mentioned study.

2. The proposal has been evaluated and found to have merit.

3. **Kindly be informed that permission to conduct the study has been granted under the following conditions:**

3.1 The data to be collected must only be used for academic purpose;

3.2 No other data should be collected other than the data stated in the proposal;

3.3 Stipulated ethical considerations in the protocol related to the protection of Human Subjects should be observed and adhered to, any violation thereof will lead to termination of the study at any stage;

3.4 A quarterly report to be submitted to the Ministry's Research Unit;

3.5 Preliminary findings to be submitted upon completion of the study;

3.6 Final report to be submitted upon completion of the study;

3.7 Separate permission should be sought from the Ministry for the publication of the findings.

4. All the cost implications that will result from this study will be the responsibility of the applicant and **not** of the MoHSS.

Yours sincerely,

MR. BEN NANGOMBE
EXECUTIVE DIRECTOR

"Health for All"

Annexure E: Data collection tool

DATA EXTRACTION FORM

Factors Associated with delay in the starting of Anti-Retroviral Treatment (ART) among Confirmed HIV Positive Individuals in Northern Namibia

Name of Data Extractor: Elsie T Hlahla Date of Extraction _____

Unique ART_ Number of Newly started ART Patient (Code)	Date Confirmed HIV+	Gender	Age in years	Date of Start of ART	Facility type (Code) Where Started ART	WHO Clinical Stage at Start of ART	CD4 counts cells/µL at Start of ART	Viral load copies/mL at Start of ART

Annexure F: Proof of Language Editing

I hereby acknowledge that I have edited Mrs Elsie Hhahla's thesis submitted in partial fulfilment of the requirements for the degree of Master of Public Health titled "**Factors Associated with Delay in starting Anti-Retroviral Treatment (ART) among Confirmed HIV Positive Individuals in Northern Namibia**".

The work comprised of proof reading and editing, which includes but not limited to:

- providing comments pertaining to how the researcher's work flowed,
- areas where further clarity or description may be required,
- sentence structure, punctuation and grammar,
- reflections on in-text referencing, table and figure presentation styles.

I trust you will find this in order.

Kind regards,

Dr Gamuchirai Mutezo