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Demographic and Clinical Characteristics Predicting Missed Clinic Visits Among Patients Living with HIV on Antiretroviral Treatment.

Osaremhen Ikhile

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Demographic and Clinical Characteristics Predicting Missed clinic visits among patients living with HIV on Antiretroviral Treatment.

by

Osaremhen Ikhile

(Under the direction of Gulzar H. Shah)

ABSTRACT

Background: People living with HIV (PLHIV) often face challenges that contribute to missed clinical care which can impact their health outcomes.

Purpose: The primary objective of this study was to examine associations of clinical and sociodemographic factors such as age at the entrance into antiretroviral treatment (ART), rurality-urbanicity, biological sex, province of residence, and viral load with PLHIV's tendency to miss scheduled visits for ART among PLHIV in the Kinshasa and Haut-Katanga provinces of the Democratic Republic of Congo (DRC) between 2018 and 2019.

Methods: The study participants for this quantitative study were 5338 adults living with HIV who received ART for 12 months, from July 2018 to June 2019. Descriptive statistics was computed to show the level of missed appointments for ART. Associations of clinical and sociodemographic factors with tendency to miss scheduled visits were estimated using multivariable logistic regression analysis.

Results: Three hundred and twenty-nine (6%) PLHIV experienced at least one missed visit while 5009 (94%) experienced no missed visits. PLHIV that had a viral load greater than or equal to 1000 copies/ml (20%) were a small proportion of the study participants. Those that were from semi-rural (76%) were a greater proportion of the study participants compared to rural (18%) and urban (6%), and regarding age, older PLHIV greater than or equal to 18 years (89%) were a

greater proportion of the study participants Chi-Square tests of association showed that of the variables analyzed, only Rural-Urban and Age at start of ART had a statistically significant relationship with missed visit ($P < .0001$, 0.04 respectively). There was no significant association between biological sex, province, viral load and missed visits.

Conclusion: The findings from this study strongly suggest that there is a significant association between certain demographic factors, age and rurality-urbanicity and missed visits. The study findings have implications for policy and interventions targeting PLHIV at higher risk of missed visits.

INDEX WORDS: HIV/AIDS, ART, PLHIV, DRC, Missed Visits

Demographic and Clinical Characteristics Predicting Missed clinic visits among patients living
with HIV on Antiretroviral Treatment.

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with HIV on Antiretroviral Treatment

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DEDICATION

I dedicate my dissertation to God, who has been so faithful in my life, shining light on my path.

To my spouse for your loving support and encouragement.

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CHAPTER 1

INTRODUCTION

Significant progress has been made to improve the health conditions of people living with HIV (PLHIV). The discovery of Antiretroviral treatment (ART) was a major turning point for HIV, the disease that leads to AIDS. Life expectancy for greater than 1.2 million PLHIV is now comparable to that of the general population, (CDC 2019; Samji et al., 2013) in part due to the development of effective antiretroviral therapy (ART) (Antiretroviral Therapy Cohort Collaboration, 2015; Zuniga et al., 2020). Immense global efforts have made access to ART possible worldwide. By the end of 2015, seventeen million people had initiated ART through global efforts during the past 15 years (Wang et al., 2016; UNAIDS, 2016), resulting in a 35% decrease in AIDS-related deaths since 2005, with 3/4 of them still occurring in sub-Saharan Africa (UNAIDS, 2016; SSonko et al., 2015).

Despite this major health achievement, the health outcomes of PLHIV continue to be threatened by incomplete treatment. Successful engagement in care provides opportunities for screening, prophylaxis, as well as monitoring of ART, viral load, and the treatment of comorbid conditions (Institute of Medicine 2012) (Batey et al., 2020). Continuous engagement in care after HIV diagnosis offers maximum benefit from ART and increases viral load (VL) suppression (Mugavero et al., 2012; Jiamsakula et al, 2018). However, there are strict adherence levels required to achieve these benefits (Shah et al., 2021b) and PLHIV experience unique challenges in establishing self-care and adherence behaviors (Mugavero et al., 2009; Fleishman et al., 2012; Pence et al., 2019).

There is evidence that missed medical appointments are associated with poorer health outcomes (Zinski et al., 2015; Kay et al., 2019), such as increased mortality (Giordano et al., 2007;

Horberg et al., 2013; Mugavero et al., 2009; Baley et al., 2020; Thompson et al., 2012; Kay and Westfall 2020; Skarbinski et al., 2015; Mugavero et al., 2010; Mugavero et al., 2014; Crawford 2014; Waldrop-Valverde et al., 2014; Safo et al, 2017; Holberg et al., 2013; Kay et al, 2019; Gardner et al., 2014; Spinelli et al, 2018; Nijhawan et al, 2017; Kiwuwa-Muyingo et al., 2013). Increased mortality rates due to inconsistent access to ART affect both resource-rich and resource-limited settings (Horberg et al., 2013; Zhang et al., 2012; Jiamsakula et al, 2018) (such as the DRC).

The primary determining factor of VL suppression and risk of transmission according to the CDC is the patient's adherence to ART (Shah et al., 2021b). Lack of visit constancy results in higher viral loads, (Skarbinski et al., 2015; Mugavero et al., 2010; Mugavero et al., 2014; Crawford 2014; Waldrop-Valverde et al., 2014; Safo et al., 2017; Nijhawan et al., 2017; Kang, Bang and Cho, 2018; Bangsberg et al., 2000; Parienti et al., 2004; Nachega et al., 2007; Nieuwkerk et al., 2005; Kiwuwa-Muyingo et al., 2013) which have important implications both for individual well-being and HIV transmission (CDC, 2013; Haley et al., 2014; Wasti et al., 2012; Chirambo et al., 2018). Higher viral load, progression to AIDS, and death are consequences of missed visits which further constitutes a risk to public health because the benefits of HIV transmission risk reduction from ART are lost (Mugavero et al., 2012; Cohen et al., 2011; Nijhawan et al, 2017). Also, PLHIV with sub-optimal treatment may experience antiretroviral drug resistance. (Bangsberg et al., 2000; Parienti et al., 2004; Nachega et al., 2007; Nieuwkerk et al., 2005; Kiwuwa-Muyingo et al, 2013).

The number of medical appointments missed is an informative indicator of retention in care. (Tarantino et al, 2018; Pence et al., 2018; Kay et al, 2019). This indicator helps in identifying individuals at risk for poor health outcomes (Mugavero et al., 2012). When PLHIV show an early suboptimal adherence to treatment schedules, future appointments are challenged (Jiamsakula et

al., 2018; Woodward et al., 2015; Pence et al. 2019; Thompson et al., 2012; Kay and Westfall 2020; Nijhawan et al, 2017; Zinski et al., 2017; Spinelli et al, 2018). For example, PLHIV who did not attend a recommended number of medical appointments in a year were at heightened risk for being lost to follow-up (Agwu et al., 2015). Missing two or more visits in the past year was associated with lower odds of being on ART and achieving viral suppression (Kahana et al., 2015). A retrospective cohort study by Kay et al., 2019, showed that, missing 3 or more scheduled HIV primary care visits over a 1-year period increased mortality risk for PLHIV (Kay et al, 2019). In this study, PLHIV who missed three or more scheduled visits had nearly four times the mortality risk than PLHIV who did not miss any scheduled visits (Mugavero et al., 2014; Kay et al, 2019). Similarly, a high number of missed visits is associated with poor ART adherence, virologic failure, and increased mortality (Skarbinski et al., 2015; Mugavero et al., 2010; Crawford et al., 2014; Waldrop-Valverde et al., 2014; Safo et al., 2017; Mugavero et al., 2014; Jiamsakula et al., 2018).

Continuity in care is an important construct in the public health response to the HIV epidemic which can be used to determine the success of ART programs. Lack of continuity in treatment schedule may indicate a significant failure in the quality of care which manifests as inefficient utilization of clinic resources (Nijhawan et al., 2017). It is important that PLHIV do not lose treatment continuum to improve their health and to reduce the potential for HIV transmission. However, long-term adherence in low- and middle-income countries is met with numerous patient- and program-related challenges, (WHO, 2015; CDC 2014; Shah et al, 2021b). An understanding of the issues prompting missed visits in DRC can be used to effectively guide reengagement interventions (Mugavero et al., 2014; Zinski et al., 2015; Garder et al., 2014; Spinelli et al, 2018).

The DRC is a country that stretches over 2 million kilometers with its capital in Kinshasa, a densely populated mega-city of 11 million inhabitants (Rogers et al., 2017). Compared to Sub-

Saharan Africa (SSA), less than 25% of eligible PLHIV are on treatment in DRC, which is substantially lower than the SSA average (Gao et al., 2001). The DRC is also the epidemiological epicenter of the HIV pandemic and a reservoir of circulating HIV strains that have exhibited high levels of diversity and recombination. There is evidence that HIV-1 originated from the Congo Basin (Rogers et al., 2017).

Statement of the Problem

Missed visits have a direct impact on an individual's ability to manage their HIV viral-load and in turn, on their health. Patients who miss appointments miss out on timely delivery of HIV services, resulting in a lack of viral load suppression. Consequently, their acute illnesses may become chronic, elevating their risk of HIV transmission and mortality.

There are economic implications of interruption in treatment. Globally, between US\$22 and US\$24 billion is being spent annually on HIV with an individual cost of US\$4707 over a lifetime. HIV/AIDS constitutes a drain on the labor force and government expenditures in DRC (Emina et al., 2012).

High rates of missed visits may compromise the achievement of the sixth objective of the Millennium United Nations Development Goals in the African region thereby casting doubts on existing strategies addressing this issue bearing in mind that DRC may be undermined by civil and political unrest (Carrel et al., 2016). A recent retention study of PLHIV in the DRC involved Kinshasa (Shah et al, 2021a) however, little is known about missed visits among PLHIV in Kinshasa and Haut-Katanga.

Purpose of the Study

The primary objective of this study is to determine the level of missed clinical care visits for HIV/AIDS among PLHIV and to examine demographics and clinical characteristics associated with missed visits in the Kinshasa and Haut-Katanga provinces of the Democratic Republic of Congo.

Research questions and design

This study is a retrospective cohort study. It pursues three research questions:

- 1) Does the risk of missed clinical care visits for HIV/AIDS among PLHIV vary by demographic characteristics?
- 2) Does the risk of missed clinical care visits for HIV/AIDS among PLHIV vary by the rurality-urbanicity status of the treatment centers?
- 3) Are clinical characteristics of PLHIV associated with the risk of missed clinical care visits for HIV/AIDS?

These research questions are associated with five research hypotheses.

Hypothesis

H11: There is a difference in missed clinical visits between male and female PLHIV

H10: There is no difference in missed clinical visits between male and female PLHIV

H21: There is a difference in missed clinical visits between young PLHIV and those of older ages.

H20: There is no difference in missed clinical visits between young PLHIV and those of older ages.

H31: There is a difference in missed clinical visits between HIV-infected PLHIV with higher viral and those with lower viral load.

H30: There is no difference in missed clinical visits between HIV-infected patients with higher viral and those with lower viral load.

H41: There is a difference in missed clinical visits between PLHIV receiving care in the Kinshasa treatment center and those receiving care in the Haut-Katanga treatment center.

H40: There is no difference in missed clinical visits between PLHIV receiving care in the Kinshasa treatment center and those receiving care in the Haut-Katanga treatment center

H51: There is a difference in missed clinical visits between PLHIV receiving care in rural health zones and those residing in urban health zones.

H50: There is no difference in missed clinical visits between PLHIV receiving care in rural health zones and those residing in urban health zones.

Delimitations

This study focuses on CDC funded clinics in Kinshasa and Haut-katanga provinces of the DRC between 2014 and 2019. Health centers that are not CDC program centers in these two provinces are excluded from this study. The sample captures both adult and children PLHIV in these two provinces of DRC. It focuses on viral load measure at baseline as its clinical predictor of missed visits and uses age at entry into ART between 2014 and 2019.

Significance of the Study

Determining the demographic and clinical factors predicting missed visits in Kinshasa and Haut-Katanga of the DRC which is not well documented will allow for appropriate intervention strategies to be implemented, enabling health care providers to establish the long-term treatment plan to ensure optimal treatment responses by PLHIV. This study will contribute to strengthening the quality of the HIV continuum of care and help the country and PEPFAR move toward their aspiration of an AIDS-free Generation (Amboko and Brysiewicz, 2016). There is a paucity of studies looking at missed visits among PLHIV in DRC, exposing the uniqueness of this study. Also, the data for this study was collected for a different purpose. This study promises to be a seminal study that would create a need to further collect all data specific to missed visit among PLHIV. A look at missed visits among PLHIV in this area using this data would contribute to the body of knowledge on factors that need to be considered when planning HIV interventions. The result of this study can be used to inform interventions in neighboring African countries that share the same health and economic profile as the DRC.

Definition of Terms

HIV: A particular virus that can only infect human beings, weakens the immune system by destroying important cells that fight disease and infection, and reproduces itself by taking over a cell in the body of its host, which helps fight against diseases.

AIDS: Acquired Immune Deficiency Syndrome: 1) Acquired means you can get infected with it; 2) Immune Deficiency means a weakness in the body's system that fights diseases; 3) Syndrome means a group of health problems that make up a disease.

PLHIV: People Living With HIV/AIDS

HIV viral loads: The HIV viral load measurement indicates the number of copies of HIV-1 RNA per milliliter of plasma. Although HIV ultimately resides within cells, the plasma measurement is an accurate reflection of the burden of infection and the magnitude of viral replication. It is used to assess the risk of disease progression and can help guide the initiation of therapy. It is critical in monitoring virologic response to ART (HRSA/ HAB, 2001).

Missed Visits: All missed-visits measures are based on “no-shows” for scheduled, primary care visits. The missed visit will be a dichotomous measure. The missed visit count measure will capture how many scheduled appointments the patient missed in the observation period. (Kay and Westfall, 2020).

Viral load (VL): the number of copies of HIV RNA in a milliliter of blood (Kranzer et al., 2008).

ART: Antiretroviral Treatment

Baseline: Baseline is defined as the date of the first CD4 percentage result; as in previous studies (Edmonds et al., 2012)

Age: refers to age at enrollment for Antiretroviral treatment

Gender: refers to biological sex, at birth. The categories “male” and “female,” are used for the purpose of this study.

Rurality/urbanicity: refers to the categories “urban”, “rural,” and rural-urban.

Province: refers to Kinshasa and Haut-Katanga provinces of the Democratic Republic of Congo.

CHAPTER 2

LITERATURE REVIEW

Overview of chapter

The literature reviewed for this present study has been structured to discuss various retention measures, define missed visits, and elaborate on the epidemiologic and socioecological background of the issue. The chapter also hinges on theory while expounding on community health implications of missed visits, current strategies to address the issue and recommendations on how to move forward.

Prevalence of missed visits among PLHIV

Missed visits for PLHIV has been approached using diverse metrics. The Institute of Medicine (IOM) uses an indicator of two primary care visits separated by more than 90 days during a 12-month period (IOM, 2012; Kay et al., 2020) known as retention in care. Critics have argued that indicators such as this can fail to consider people who have been living with HIV for longer and/or are on established treatment regimens, but who, nonetheless, may require fewer medical visits than PLHIV who are newer to care. (Kay et al., 2020).

Kay and colleagues, in their seminal study, suggest that, for PLHIV with established treatment regimens, the missed visit indicator may be a more appropriate performance measure, as it does not depend on a particular visit schedule that may vary across PLHIV presenting diverse biopsychosocial characteristics. In their study, a missed visit was defined as one that was not canceled by the patient or provider at any point prior to the scheduled visit (Kay et al., 2020).

Chirambo and colleagues' definition of continuity in care was guided by country (Malawi) HIV guidelines that classify one as a defaulter when one does not report to the clinic for two consecutive months and is projected to have run out of drugs with no information on whether one stopped, transferred or died. On the other hand, a compliant client was defined as one who was alive on ART and had never stopped taking ART treatment (Chirambo et al., 2019). Similarly, in Uganda and Zimbabwe, three measures of nonoptimal adherence included missing a dose, not responding to the adherence questionnaire, and missing a visit at least once during a preceding 6-month period, which independently predicted increased immediate mortality risk in patients only monitored using clinical symptoms (Kiwuwa-Muyingo et al., 2013).

A missed visit was defined as any scheduled clinic visit with an HIV medical provider that was not kept (Safo et al., 2017). Similar to this, in another study, unkept appointments that were not canceled by the patient or clinic staff were labeled as missed visits and these were captured continuously (summed for the total number of missed visits) and dichotomously (0=kept the visit, 1=missed the visit) with more missed visits indicating worse retention in care. (Zuniga et al., 2020). Yet, in another study, a missed visit was defined as having no assessments within six months (Jiamsakula et al., 2018) while visit constancy was defined as visit attendance during regularly spaced intervals (Mugavero et al., 2014, Spinelli et al., 2018).

Batey and colleagues in a more nuanced approach, captured six different measures of visit constancy, each with a unique aspect of engagement in care (Mugavero et al., 2012, Kay and Westfall, 2020, Batey et al., 2021) including a 4-month constancy measure which calculated the number of 4-month intervals within the 12-month period that a patient had at least one kept visit (range: 0–3 intervals) (Kay and Westfall, 2020, Batey et al., 2021). In this retrospective cohort study, all six measures were significantly associated with viral suppression; however, no single

measure predicted viral suppression with both high specificity and high sensitivity (Mugavero et al., 2012; Batey et al., 2021).

Haley and colleagues' metric was based on one that was not completed within the allowable follow-up visit window. In this attempt at capturing visit constancy, it was approached by the completion of the final scheduled in-person study visit within the allowable study window was satisfactory. Incident upon this metric, a participant enrolled in the 12-month cohort could miss a visit at 6 months and still be considered satisfactory attendance if the 12-month visit was completed. Participants who were not engaged at the end of the site follow-up activities did not meet their metric (Haley et al., 2014).

Mugavero and colleagues proposed that measures that are based on kept or "attended" visits (such as the IOM indicator), as well as missed visits, should be used together in clinical settings to maximize prognostic value (Mugavero et al., 2012, Kay and Westfall, 2020). Similarly, other researchers used missed visits, or "no shows," as a common way to assess patient's regularity in HIV care due to the ease of its measurement and its relevance to clinical outcomes (Tsao et al., 2012 Mugavero et al., 2010, Safo et al., 2020). On the other hand, Spinelli and colleagues noted that, although measuring visit constancy was better at capturing the density and appropriate spacing of care encounters, it is computationally intensive, and complementary methods are needed to direct real-time re-engagement efforts (Zinski et al, 2015, Spinelli et al, 2018).

For this study, all missed-visits measures will be based on "no-shows" for scheduled, primary care visits. The missed visit will be a dichotomous measure. The missed visit count measure will capture how many scheduled appointments the patient missed in the observation period following the definition by Kay and Westfall (2020).

Epidemiologic background about PLHIV

In 2020, 37.7 million people were living with HIV and about 1.5 million people were newly infected with HIV globally (UNAIDS, 2020) HIV prevalence in DRC is 1.2% countrywide and 1.6% in Kinshasa (coffee, 2008). DRC is bordered by nine other countries whose HIV prevalence rates range from 1.0% (0.9–1.1) (Burundi) to 12.5% (11.9–13.3) (Zambia). (Carrel et al, 2016). Prevalences in sub-Saharan Africa were estimated at 1.0% (0.9–1.2) among adults aged 15–49 in 2013 (Faria et al., 2014; UNAIDS, 2014; Vidal et al., 2000; Worobey et al., 2008; Carrel et al, 2016).

Approximately 50% of newly diagnosed individuals are linked to HIV care and retained in care (Eaton, Saag & Mugavero, 2014, Skarbinski et al., 2015, Tedaldi et al., 2014, Safo et al., 2020). Based on the Institute of Medicine's indicator, the Centers for Disease Control and Prevention (CDC) estimates that 48 percent of people living with HIV (PLHIV) in the US are retained in care (HRSA, 2019, Kay et al., 2019). Other studies have found lower rates, for example, a no-show rate of 17% (Bofll et al., 2011, Traeger et al., 2012, Nijhawan et al., 2017) which was lower than those reported in several other recent studies (Pence et al., 2018). A cross-sectional study in the U.S. showed 35% of missed visits among PLHIV (Tarantino et al., 2018) while an observational clinical cohort study in the U.S. showed 17% of missed visits among PLHIV (Pence et al., 2018). In Korea, a cross-sectional study revealed 12.5% missed visits (Kang, Bang & Cho, 2018). Studies in Malawi showed that the defaulting rate averaged 19% to 22% (Chirambo et al., 2019).

It's been more than a decade since the first attempt to study retention rates for PLHIV in DRC. The first study that assessed retention in DRC in 2007 when ART coverage was only 12 percent, found a retention rate of 81.4%, 75.2%, 65.0%, and 57.2% at 6 months, 1 year, 2 years,

and 3 years (WHO, 2010) respectively with semi-urban sites experiencing the least retention rates. These rates were like the rates reported from other Sub-Saharan Africa (Rosen et al., 2007, Tassie et al., 2010) with higher ART coverage of 36 percent (Koole et al, 2012). Results from a meta-analysis showed that only 75% of PLHIV who started on ART were still in care after 1 year, and about 61% after 2 years (Rosen et al., 2007, Koole et al., 2012).

Social-Ecological background and correlates of missed visits.

Missed visits among PLHIV can be understood from a socioecological perspective, elucidating PLHIV's vulnerability at different levels.

Individual level

At the individual level are factors such as age, gender, knowledge, attitudes, and beliefs as well mental and physical health of PLHIV.

Age

Among youth, missed visits have been linked to decreased ART adherence (Ernesto et al., 2012, Tarantino et al., 2018). Similarly, other studies reveal that youth were more likely to experience discontinuous engagement in care. (Crawford, Sanderson,&Thornton, 2013, Marx, Malka, Ravishankar, & Schwartz, 2011, Batey, et al, 2021, Ernesto et al., 2012; Zhang et al., 2014, Asimwe, Kanyesigye, Bwana, Okello, & Muyindike, 2016, Mburu et al., 2016, Megerso et al., 2016, Rachlis et al., 2016, Jiamsakula et al., 2018) Despite some revelations about YLH being particularly challenged with missing medical appointments, much attention has been paid to seeking this trend in adults (Horberg et al., 2013; Kipp et al., 2017; Traeger, O'Cleirigh, Skeer, Mayer, & Safren, 2012; Zinski et al., 2015; Tarantino et al, 2018). Missed visits among adults were associated with viral non-suppression (Mugavero et al., 2012; Zinski et al., 2015), low CD4

count (Horberg et al., 2013), AIDS-defining illnesses (Park et al., 2007), and mortality (Horberg et al., 2013, Mugavero et al., 2009, Park et al., 2007, Tarantino et al., 2018). Older age was found to be protective of being established in care (Nijhawan et al., 2017).

Another study categorized reasons for missed visits by age group and showed that adults 35–49 years were more likely to default treatment due to treatment side effects, while among subjects aged 20–34 years, low income was a reason for missed visits (Kang, Bang, and Cho, 2018). Studies in infants showed 5% of infants never returned to care following enrollment and 18% were loss to follow-up (LTFU) by 18 months. The 18-month cumulative incidence of LTFU was 8% among infants whose mothers initiated combination antiretroviral therapy (cART) by infant enrollment and 20% among infants whose mothers were not yet on cART. A recent meta-analysis of 11 studies conducted in sub-Saharan Africa estimated that 34% of HIV-exposed infants are lost from care by three months of age, with some settings reporting over 70% LTFU (Sibanda et al., 2013, Feinstein et al., 2015).

Biological Sex

Males are more likely to experience some discontinuity in care (Batey, et al., 2021, Crawford, Sanderson & Thornton, 2013; Marx, Malka, Ravishankar, & Schwartz, 2011, Asimwe, Kanyesigye, Bwana, Okello, & Muyindike, 2016; Mburu et al., 2016; Megerso et al., 2016; Rachlis et al., 2016; Zhang et al., 2014). On the other hand, other studies have shown that being female was associated with missed visits (Kay et al., 2019, Jiamsakula et al., 2018, Asimwe, Kanyesigye, Bwana, Okello, & Muyindike, 2016; Mburu et al., 2016; Megerso et al., 2016; Rachlis et al., 2016; Zhang et al., 2014) Women enrolled in HIV treatment trials experienced higher rates of antiretroviral therapy (ART) discontinuation than men (Squires et al., 2013, Squires et al., 2011, Falcon et al., 2011). Though a loss to follow-up was a common reason for this discontinuation, it

was unclear why PLHIV were lost to follow-up (Squires et al., 2013; Squires et al., 2011; Falcon et al., 2011; Haley et al., 2014). In another study, mothers greater than 24 years of age, had a significantly reduced rate of missed visit frequency and risk of 18-month missed visits compared to younger women. (Kwanele Ngandu et al, 2019). Yet, other studies have observed heterosexual orientation, as a risk factor for missed visits (Israelski et al., 2001; Poole et al., 2001; Mugavero et al., 2001; Kang, Bang and Cho, 2018).

Race

There have been reports of race as a risk factor for missed appointments. (Crawford, Sanderson, & Thornton, 2013; Marx, Malka, Ravishankar, & Schwartz, 2011; Batey, et al., 2021). Just as racial disparities exist for new HIV infections, race continues to contribute to HIV-related outcomes (Haley et al, 2014).

Mental health

Studies have linked mental health to risk of missed visits (Crawford, Sanderson, & Thornton, 2013; Marx, Malka, Ravishankar, & Schwartz, 2011; Batey, et al., 2021). There is evidence that fear exhibited by PLHIV of disclosure of a positive HIV status and fear of side effects of the HIV medication led to missed visits (Forsythe, 1998). PLHIV have also defaulted due to hopelessness (Forsythe, 1998; Kay et al., 2019; Chirambo et al., 2019). Yet, another reason PLHIV have defaulted treatment was due to fatigue (Forsythe, 1998; Kay et al., 2019). A qualitative study revealed that PLHIV experienced ART fatigue due to daily drug intake and concerns about it being a lifelong activity. As a result of these, it was common for PLHIV to decide to take breaks from treatment or default totally (Chirambo et al., 2019). Motivation plays a role in treatment adherence and being able to negotiate the individual and structural barriers that

caregivers encounter during the treatment cascade for children with HIV (Coetzee, Kagee, & Vermeulen, 2011). Other risk factors include forgetfulness (Kahana et al., 2016), depression (Kay et al., 2019), psychiatric conditions (Tsao et al., 2004), psychosocial characteristics, such as poor social support (Beach et al., 2006) and experience with the stigma attached to HIV (Stutterheim et al., 2012; Kang, Bang, and Cho, 2018).

Education

Low literacy, which is difficulty in obtaining, processing, and understanding basic health information in order to effectively navigate the health system, has been associated with inadequate management of long-term conditions (Palumbo, 2015). Low education level was shown to predict missed visits for HIV medical care (Israelski et al., 2001; Poole et al., 2001; Kang, Bang and Cho, 2018) In addition, denial of one's HIV status compounded by inadequate knowledge may lead to PLHIV missing their appointments (Chirambo et al., 2019).

Physical health

Studies have shown that a lower CD4 cell count accounted for missed visits. (Horberg et al., 2013; Zhang et al., 2012; Jiamsakula et al., 2018). A qualitative study revealed that absence of symptoms, low severity of illness (Asefa et al., 2013; Hardon, 2006; Jones et al., 2015) experiencing a positive change in one's health, especially being virally suppressed caused a better perception of one's health prompting defaulting habits towards treatment (Chirambo et al, 2019). On the other hand, in this same study, side effects of ART initiation such as vomiting, skin rashes, and jaundice contributed to defaulting from treatment despite PLHIV being advised that such symptoms will wane (Chirambo et al., 2019). Patients who previously missed visits were more likely to not be retained in care (Kay et al., 2019). Other studies found that higher CD4 cell count,

(Yang et al., 2015; Crawford, Sanderson, & Thornton, 2013; Berg et al., 2005) diagnosis of acquired immune deficiency syndrome (AIDS) (Arici et al., 2016; Kang, Bang and Cho, 2018) were risk factors for missed visits. In addition, there is mounting clinical evidence that increases the recognition that genetic factors can affect how a person may respond to therapy. (Shah et al, 2021b) Yet in another study, association between weak retention of PLHIV on antiretrovirals and a gradual change in nutritional status have been observed (Koy et al, 2014).

Religious belief

Religious beliefs have been associated with a lack of retention in care (Forsythe, 1998). However, a study showed that high-level religiosity/ spirituality improved the mental wellbeing of caregivers of children with HIV helping them to stick with HIV treatment (Osafo et al., 2017). Religious beliefs may therefore serve as moderators of psychosocial issues relating to HIV (Osafo et al., 2017).

Substance use disorder

Substance use disorder was found to predict missed visits (Crawford, Sanderson,&Thornton, 2013; Marx, Malka, Ravishankar, & Schwartz, 2011; Batey, et al, 2021). Intravenous drug use was a risk factor for missed visits in several studies (IDU) (Horberg et al., 2013; Zhang et al., 2012; Jiamsakula et al, 2018; Rumpitz et al., 2007; Kang, Bang, and Cho, 2018). Further, current alcohol use, and being a former drug user were associated with difficulty establishing care (Giordano et al., 2005; Nijhawan et al., 2017). Marijuana use was associated with missing the next scheduled appointment in a study by Kipp and colleagues (Kipp et al., 2017).

This study showed a non-linear dose-response for frequency of marijuana use and missed visits, with daily users having the highest risk compared to non-users. Daily marijuana use had a negative impact on HIV clinic attendance (Kipp et al., 2017).

Unemployment

Unemployment was shown to predict missed visits (Kay et al., 2019; Nijhawan et al, 2017) PLHIV who are unemployed in meeting the cost associated with treatment. Financial constraints can complicate accessing long-distance treatment centers, especially among those residing in rural areas (Miller et al., 2010; Wasti et al., 2012; Chirambo et al., 2019). Costs of care may play a role in retention (WHO 2010; CDC, 2014; Shah et al, 2021b) while poverty was predictive of missing 3+ visits (Kay et al., 2019).

Interpersonal level

At the interpersonal level are factors such as social norms, access to diverse and supportive networks/influences). The type and quality of support given by household members can play a role in adherence to HIV treatment. Lack of support from a partner has been shown to compromise treatment adherence (Hardon et al., 2006, Asefa et al., 2013). A qualitative study revealed that PLHIV do not want their relatives or partners to learn their positive status for fear of being stigmatized. In such cases, there is no one to remind them when they miss the drugs (Chirambo et al., 2019). Fear of disclosure of one's status was the most common reason for defaulting from ARVs (Chirambo et al., 2019). Stigma and discrimination coupled with family pressure predicted lack of treatment adherence (Forsythe, 1998; Miller et al., 2013; Chirambo et al., 2019). Intimate partner violence prevents the needed supportive network for parents of children with HIV. A study by Margaret et al., 2018 in the Democratic Republic of Congo found a high prevalence of intimate

partner violence and associated non-adherence to HIV treatment. A study's weighted percentages of missed visits appeared to differ significantly by type of disclosure of mother's HIV status to family or friends and by reports of discrimination (Ngandu et al., 2019). Derogatory labels commonly used for people living with HIV in the Democratic Republic of the Congo, describe them as walking corpses, danger to others, or people deserving to die before others were infected (Mupenda, et al 2015). Fear of discrimination among close relatives can impact visit constancy.

Organizational level

At the organizational level are determinants such as norms, rules and regulations, incentives and benefits as well as structures. Structural determinants may directly affect the adherence behavior of people dealing with HIV. The dynamics of the health systems which include human resource factors and accessibility of services can impact visit constancy of PLHIV. Some studies have shown that distance to clinics, long wait times at clinics (WHO 2010; CDC, 2014; Shah et al., 2021a), and regular changes of residence predicted retention (O'Connor et al., 2013; Hill et al., 2010; Shah et al., 2021a). Financial cost associated with accessing treatment is secondary to long-distance, especially among those residing in rural areas (Miller et al., 2010; Wasti et al., 2012; Chirambo et al, 2019).

Case management and transportation assistance are good predictors of adherence behavior in HIV care (Wachira et al., 2014; Gourlay et al., 2014; Dunning et al., 2014; Kalk et al., 2016). Supplementary support services, (Kay et al., 2019) and shorter travel time to health facilities lowered the occurrence of 'MV-frequency' (Ngandu et al., 2019). These types of assistance are positive reinforcements which that decrease the likelihood of adverse outcomes (Osaremhen and Ehireme, 2023).

In African settings, accessibility to health facilities, in particular, availability of transport, transport costs, and longer distances are obstacles to retention in care (Geng et al., 2010; Wachira et al., 2014). A study in South Africa showed that shorter time spent traveling to healthcare facilities by walking or public transport was an important factor for achieving good retention in care among mothers and their young children. According to this study, PLHIV who took less time traveling to healthcare facilities, within 30 min, by walking or using public transport, had better outcomes compared to those who owned cars. The latter were not different from public transport users or walkers who took longer than 30 min to reach the facilities. The authors suggested that investment in sustainable mobile clinics for remote settings could enhance the uptake of health care among communities living far from healthcare facilities (Ngandu et al., 2019).

At health centers, services such as adherence counseling that parents receive may be sub-optimal and the content quite minimal (Coetzee, Kagee, & Bland, 2016) contributing to inadequate knowledge about the benefits of ARVs from ART care. Resource-poor settings may be plagued by insufficient numbers of adequately trained health care personnel able to provide sophisticated psychological care (WHO, 2020). A qualitative study showed that a poor relationship between health care workers and PLHIV contributed to participants defaulting from ART. An interview of both health workers and PLHIV revealed that shortages of ART providers led to clients experiencing long waiting times and which could encourage defaulting (Chirambo et al, 2019). Due to a significant number of hospitals and health centers being insufficiently equipped in sub-Saharan Africa (Olley, Seedat & Stein, 2004), almost all of the country 's programs for the fight against HIV are supported by international organizations (Zola et al., 2014).

Also, because the DRC is highly vulnerable to conflict, scaling up programs for PLHIV can be challenging (Out of focus, 2016) which may exacerbate disruptions of health care provision

(Overcoming Challenges in Global Health, 2016). This environment, often confronted by multiple unmet basic health care needs, and fragmented and fragile health systems is a challenging operating environment (COE) (Griffiths & Ford, 2013; Ssonko et al., 2015).

Insurance status

Insurance status may play a role in retention (Crawford, Sanderson,&Thornton, 2013; Marx, Malka, Ravishankar, & Schwartz, 2011; Batey, et al, 2021). lack of medical insurance was shown to predict missed visits for HIV medical care (Mugavero et al., 2009; Palacio et al., 1999; Kang, Bang & Cho, 2018). Being a beneficiary of the National Medical Aid in subjects was associated with missed visits among PLHIV ≥ 50 years in a study in Korea (Kang, Bang & Cho, 2018). In another study in the U.S., lack of health insurance was identified as an important contributor to missing clinical visits in women living with HIV (Haley et al, 2014).

Community-level

The community-level determinants include community norms, values, attitudes, & power structures. Community violence and stigma have been identified as pathways to psychological distress in people dealing with HIV (Cluver et al., 2012) which has been previously shown to impact commitment to care. Some communities and cultures require the wife to obtain her husband's permission to be tested for HIV, possibly placing the woman in a dangerous situation if her partner suspects her request of testing arises from either her infidelity or suspicion of his (Bwalya et al., 2020). In the Democratic Republic of Congo (DRC), the act of not disclosing one's serostatus to one's partner was a felony since 2008 (Zola et al., 2014). Also, Sub-Saharan Africa is disproportionately affected by both conflict and the HIV pandemic (Spiegel et al., 2007) which has been shown to disrupt health services.

Recently, researchers have seen a change in spatial patterns of HIV in DRC. Rural residence was initially protective against HIV however, there has been a reversal in the last decade. HIV has diffused from urban to rural areas consistent with worldwide trends (Carrel et al., 2016). Interpolation of cluster-level HIV across the DRC by Carrel and colleagues (Carrel et al., 2016) suggested that HIV prevalence increased in the Northeast and parts of the Southeast but overall remained low across much of the country. The increase in rural HIV was driven by higher prevalence in rural women, while it decreased in rural men and rural women who lived further from cities have greater HIV prevalence and/or risk of contracting the virus (Carrel et al., 2016). In a recent study, clinics in rural areas had lower odds of treatment retention compared to urban (Shah et al., 2021a).

Policy level

At the policy level determinants include government regulations & other regulatory processes, procedures, or laws to protect the public's health. There have been efforts to reduce new infections, for example, in 2015 UNAIDS launched a new global HIV strategy to prevent 75% of new infections by 2020 and shift the global needs of ART programs by 2030 (Fast-track, 2016; On the fast track to ending the AIDS epidemic, 2016). The World Health Organization, national governments and major donors are promoting differentiated-care approaches to achieve those goals (New toolkit for differentiated care in HIV and TB program, 2016; Out of focus, 2016; Overcoming Challenges in Global Health, 2016). International HIV funding and key policies have mainly been focused on high-burden countries and HIV "hotspots." The President's Emergency Plan for AIDS Relief (PEPFAR) is spending \$50 million over five years in the DRC to combat HIV/AIDS (Carrel et al., 2016).

There is a need for policies to combat psychosocial issues that plague parents and caregivers of children living with HIV in DRC as well as a serious commitment, in terms of the government's political will. Kidman and Heymann, 2016, in their study, examined caregiver-supportive policies to improve child outcomes in twenty-five HIV prevalent countries including DRC. Their study showed fewer existing policies to combat psychosocial issues that plagued parents and caregivers of children living with HIV. They concluded that making mental health and social services more widely available was essential to support caregiving by families of HIV-affected children (Kidman & Heymann, 2016).

Community health implications

Communities that are unsupportive, place blame, or associate HIV with immorality may aggravate low treatment uptake (Underwood et al., 2014; Kranzer, McGrath & Saul 2008; Grant, Logie & Masura 2008). The fear of social exclusion, stigma, and loss of social support cause PLHIV to avoid treatment (Underwood et al., 2014; Grant, Logie & Masura 2008; Gari et al., 2013). Missed visits can be geographically clustered with rural areas being mostly impacted by access to care. Infection often results in loss of socioeconomic status, employment, income, and housing (WHO, 2020). A long-term economic impact is poverty, a reduction in investments and savings, and a rise in unemployment in vital industries such as agriculture and manufacturing (Latkin et al., 2013).

Current strategies to address the issue.

Community ART groups (CAG)

CAG are peer support groups that provide psychosocial support to HIV-positive women, men, and children in their own community (Shroufi et al., 2013; Decroo et al., 2011). Each CAG comprises between 6 to 12 members and keeps linkage with the health facility in order to receive ARVs and clinical support as needed. CAG members organize themselves to meet and provide peer support without the involvement of the health providers. These support groups also play a key role in defaulter tracing and encouraging attendance at health facility appointments. The CAG approach helps to reduce the frequency of drugs' collection from the pharmacy and therefore the cost of traveling to the clinic. One patient (volunteer) travels to the clinic to collect ARVs for other members of the CAG. The CAG strategy was shown to significantly improve patients' retention and adherence (Grimwood et al., 2012; Decroo et al., 2011; Ditekemena et al., 2014).

Mentor Mothers

Mentor Mothers is a strategy already established in Kinshasa and other DRC provinces, in which expert mothers assist newly identified HIV-positive pregnant women to navigate the Prevention of Mother to Child Transmission (PMTCT) program and who follow up with women who miss appointments, offers a model for a male version which could be implemented (Gill et al., 2017). This strategy provides psychosocial support for mothers dealing with HIV.

The Observatory

The Observatory is a community-based initiative that looks at access to and the quality of HIV services. Its main objective is to help the government and civil society define and implement

national policies in accordance with international norms and standards. It was initiated after repeated depletion of HIV medicine, requests for payment for services that were meant to be free, the persistence of stigma, discrimination, and human rights violations as well as the long distances that people had to travel to access care. It monitors three areas monthly: 1) The availability of services; 2) The quality of care, including the availability of medicine; and 3) The accessibility of care. This initiative demonstrates collaboration between civil society, health services, and donors in the HIV response. It provides the first clue regarding HIV supplies in the Democratic Republic of Congo, merges data with the National Health Information System (SNIS), and has led to the improvement of HIV services in health facilities (UNAIDS, 2021).

Recommendations in literature on how to move forward based on current strategies.

Follow up visits after missed visits

PLHIV who miss two consecutive appointment dates should be traced to their homes to explore the missed appointments. This would enable the identification of problems leading to non-adherence (Chirambo et al., 2019). Participant tracing activities may include the use of phone, text-message, mail, online, and in person locator contacts (phone calls, email, social media, visiting participant home and hangouts), as well as monitoring of online jail and prison databases. A search of death registries can be used to determine if any PLHIV who missed their final study visit were deceased (Haley et al., 2014). Strengthening community-based health care linkages with the facilities could be considered to facilitate tracing (Ngandu et al., 2019; Haley et al., 2014).

Adequate information, education and counseling

In the qualitative study conducted by Chirambo and colleagues, Health workers reported on the need for intensive counseling especially for newly initiated individuals to include both benefits and consequences of ART care and default by trained health workers. Comprehensive counseling may serve to enhance PLHIV's understanding of their treatment and may reduce the non-adherence rate from ARVs (Chirambo et al., 2019) Interventions aimed at increased access to education, may improve retention and serve as an upstream approach to retention in care. The use of technology providing culture and age-appropriate HIV health education to PLHIV can increase ART adherence and retention among older and younger PLHIV (Kay et al., 2019). A randomized control trial showed that the use of Pictograph adherence counseling increased ART adherence among adult PLHIV with marginal health literacy (Kay et al., 2019).

Reminders

Setting up for all PLHIV at the clinic automated telephone calls to remind them of upcoming primary care appointments (Kay et al., 2019). Flyers can be used to increase visual reminder cues (Haley et al., 2014).

Addressing socio-structural barriers to care

This involves ensuring wrap-around resources for example, social services, food pantries, women's well-care, compensation for time, and travel expenses are made available to participants at each visit (Haley et al., 2014). Interventions aimed at poverty reduction and support services may improve retention (Kay et al., 2019) This might involve training providers on the social determinants of health (Klein et al., 2011), to facilitate resource referrals (Tarantino et al., 2018).

Although children with HIV may rely on their caregivers to negotiate barriers and an association has been found between being a primary caregiver and treatment discontinuation (Squires et al., 2019) it has been shown that addressing the financial responsibility for children increased the probability of visit attendance (Haley et al., 2014).

Interpersonal relationship building

Haley and colleagues in their study described innovative ways to build interpersonal relationships. These include collection and regular updates of in-depth locator information by health care workers such as nicknames and aliases, monthly locator update phone calls, letters, and home and “hang-out” venue visits, birthday, holiday, “we miss you” and thank you cards, branded items (e.g., t-shirts, pens, key chains), and appreciation retention events (e.g., spa days, catered lunches) as well as permission to contact friends and family, and in some cases obtaining permission to contact participants through texting and social media, such as Facebook (Haley et al., 2014).

Community partnerships

Communities should be engaged in all stages of development and implementation of activities aimed at improving retention (Haley et al., 2014). Community partnerships should be developed, and referrals provided for situations that may affect retention (e.g., homelessness, substance use, and incarceration). A comprehensive support system linking and coordinating existing psychosocial services with each other, and health services needs to be established (WHO, 2020). Offering culturally informed behavioral health treatment, access to community services, and programs involving peer and family engagement may be used (Tarantino et al., 2018). Community organizations are unique and essential in bridging the gap and reducing the number of

new HIV infections among children as well as ensuring that women have access to the services. Building community capacities to provide counseling and support will ensure sustainability, continuity of interventions, and community development (WHO, 2020). The use of cues to actions within the community such as bus ads, community businesses, community events, and investing extensive face time to develop trusting relationships have been suggested in literature (Haley et al, 2014).

Staff capacity building

Assignment of staff members specifically to retention activities. These staff members need to be experienced in community-based approaches to retention. Staff should be provided with the training and resources needed to implement retention strategies. Just as described by Haley and colleagues in their study, retention workshops where actual case studies are presented and approaches for locating difficult-to-contact participants are discussed, ongoing capacity building and information sharing, successes and challenges, and potential strategies and best practices are critical to ensuring health workers are part of retention activities. Information sharing could enable transfer of responsibility for follow-up of PLHIV who are transferred out to other health centers limiting loss to follow-up (Haley et al, 2014). Also, systems to assess the relative cost-effectiveness of different retention strategies should be developed (Haley et al, 2014).

Psycho-social support

Including psychosocial support as part of the routine treatment is important to increase the retention rate of PLHIV (Yotebieng et al., 2017). This entails counseling, cognitive behavioral therapy, and peer support, psychosocial education, group adherence counseling, individual counseling, (Okonji et al., 2020; Spaan et al., 2018). There is evidence that psychosocial support

in the treatment of HIV is inadequate in low and middle-income countries. With adequate support, PLHIV are more likely to be able to respond adequately to the stress of being infected and are less likely to develop serious mental health problems (WHO, 2020). Counseling and social support can help PLHIV, and their carers cope more effectively with each stage of the infection and enhance their quality of life (WHO, 2020). A recent systematic review of the impact of psychosocial support in individuals dealing with HIV showed results such as increased individual self-concept and future orientation, improved parent-child communication, improved social support, and informational support (Okonji et al., 2020; Bhana et al., 2014). Further, caregivers reported improved family support, a decrease in the experience of stigma (Okonji et al., 2020, Bhana et al., 2014), adherence to clinic appointment schedules, and improved retention in care of PLHIV (Okonji et al., 2020).

The use of cognitive and behavioral strategies to empower parents and caregivers of children with HIV to negotiate problems around ART adherence and establish supportive relationships strengthen their ability to adhere which could subsequently lead to better adherence and good clinical outcomes (Adefolalu, 2019) for children with HIV. Issues around disclosure of HIV status, relaxation skills, and anxiety management skills (Adefolalu, 2019), coping with HIV, stigma and discrimination, and caregiver-child communication (Okonji et al., 2020) are addressed. Strategies for providing psychosocial support can be developed for specific groups e.g., women, youth, men who have sex with men, injection drug users, health care workers, etc. (WHO, 2020).

Building Family Support

Building family support and reducing intimate partner violence through, for example, sensitization campaigns in the community encourages partner sensitivity in service delivery. These interventions have not been consistently implemented in the DRC (Gill et al., 2017). Evidence

exists that varying forms of community sensitization and/or mobilization such as peer education through drama, male peer individual or group initiatives, safe motherhood campaigns, and involvement of influential leaders are effective at encouraging male attendance at ANC and delivery (Gill et al., 2017; Mphonda et al., 2014; Kululanga et al., 2011; Nyondo, Chimwaza & Muula, 2012).

Theoretical background

A useful theory makes assumptions about behavior, health problems, target population, that are: logical; Consistent with everyday observations; Like those used in previous successful programs; and supported by past research in the same area or related ideas (Glanz and Rimer, 2005). Theories may be explanatory or change theories. For the purpose of this research, an explanatory theory is deemed appropriate. Unlike a change theory, an explanatory theory describes the reasons why a problem exists. It guides the search for factors that contribute to a problem and can be changed.

Social Action Theory (Ewart, 1991) was previously used to explain ART adherence (Johnson et al., 2003). According to the theory, patients' sociodemographic background and behavioral health characteristics contribute to a context that influences retention behavior. In its application to retention, the Social Action Theory model proposes a cyclical process whereby PLHIV who attend their appointments gain motivation and self-efficacy which further strengthens their ability to keep future appointments (Tarantino et al., 2018).

The Health Belief Model (HBM) can be useful for explaining noncompliance with HIV treatment regimen and developing strategies to deal with Missed visits. According to the HBM, PLHIV may not follow a prescribed treatment regimen or experience missed visits unless they accept that they do in fact have a serious health condition (perceived susceptibility). They must

understand that HIV can lead to AIDS (perceived severity). Taking prescribed medication or following a recommended treatment regimen will reduce the risks of worsening conditions (perceived benefits); HIV treatments are without negative side effects or excessive difficulty of access (perceived barriers). Print materials, reminder letters, or pill calendars might encourage people to consistently follow their treatment regimen (cues to action). For those who have, in the past, had a hard time maintaining their treatment regimen, a behavioral contract might help establish achievable goals to build confidence (self-efficacy). (Rimer & Glanz (2005).

The Gelberg-Andersen Behavioral Model for vulnerable populations describes how certain populations may face specific vulnerabilities and significant barriers to obtaining health care. (Haley et al., 2014). It demonstrates relationships between predisposing, enabling, and need factors specific to vulnerable populations. The predisposing characteristics include factors that exist prior to the perception of illness and include sociodemographics (e.g., age, gender, and education), as well as variables that reflect vulnerability, such as psychological distress (e.g., depression). (Haley et al., 2014). Enabling characteristics serve as facilitators or barriers to care, such as income, health insurance, and competing needs (e.g., food insecurity) and geographic factors. (Haley et al., 2014). This model has been applied successfully to predict health service utilization (Stein et al., 2007; Haley et al., 2014) and can be extended to PLHIV in resource-poor settings such as the DRC who share many of the characteristics associated with vulnerable populations (e.g., low income, psychological distress) (Haley et al., 2014).

In this study, predisposing factors are age, gender and viral load; enabling factors were rurality/urbanicity of care facilities, as well as Province; Need refers to Antiretroviral treatment (ART); health behavior is engagement in art while health outcome is missed visit. All the constructs of this model are measurable in this study.

Figure 2.1. The Gelberg-Andersen Behavioral Model for vulnerable populations as it relates to Missed visits.

Predisposing factors	Enabling factors	Need	Health behavior
Age, Gender, Viral load	Rural vs Urban, Province	Antiretroviral treatment (ART)	Missed visit

CHAPTER 3

METHODOLOGY

Overview of the chapter

This chapter presents information regarding methods utilized by the researcher to collect and analyze data for the current research. This study is embedded in the theoretical underpinning of the Gelberg-Andersen Behavioral Model for vulnerable populations. This theory provides the researcher with a sufficient basis to understand the factors that make PLHIV vulnerable to missed treatment visits and the negative health consequences. Documenting the process by which an effect operates is an important scientific goal. This chapter establishes how the independent variables influence the dependent variable while describing the mechanism responsible for that effect.

Research questions and design

This study is observational, a type of study in which individuals are observed or certain outcomes are measured.

This study pursues four research questions: 1) Does the risk for missed visits for PLHIV vary by demographic characteristics? 2) Does the risk for missed visits for PLHIV vary by the geographic location of the treatment centers? 3) Are clinical characteristics associated with missed visits for PLHIV 4) Does the risk for missed visits vary by the geographic residence of PLHIV? These research questions are associated with five research hypotheses.

Hypothesis

H11: There is a difference in missed clinical visits between male and female PLHIV

H10: There is no difference in missed clinical visits between male and female PLHIV

H21: There is a difference in missed clinical visits between young PLHIV and those of older ages.

H20: There is no difference in missed clinical visits between young PLHIV and those of older ages.

H31: There is a difference in missed clinical visits between HIV-infected PLHIV with higher viral and those with lower viral load.

H30: There is no difference in missed clinical visits between HIV-infected patients with higher viral and those with lower viral load.

H41: There is a difference in missed clinical visits between PLHIV receiving care in the Kinshasa treatment center and those receiving care in the Haut-Katanga treatment center.

H40: There is no difference in missed clinical visits between PLHIV receiving care in the Kinshasa treatment center and those receiving care in the Haut-Katanga treatment center

H51: There is a difference in missed clinical visits between PLHIV receiving care in rural health zones and those residing in urban health zones.

H50: There is no difference in missed clinical visits between PLHIV receiving care in rural health zones and those residing in urban health zones.

Data and Methods

Research design

This is a quantitative retrospective cohort study, a type of observational study in which individuals are observed and certain outcomes are measured.

Data Source and Study Participants

This study used secondary data from routinely collected program data from 241 HIV/AIDS clinics supported by the Centers for Disease Control and Prevention (CDC) through the President's Emergency Plan for AIDS Relief (PEPFAR) in two provinces of the Democratic Republic of Congo, namely Haut-Katanga and Kinshasa. The study data comprised 5338 adults living with HIV who received HIV primary care services and were receiving ART from these clinics for 12 months, from July 2018 to June 2019. The choice of this secondary data was guided by reasons such as this data could be trusted, it contained the variables that addressed the issue/ topic, was not outdated and the collection process was efficient and standardized.

Data Management

In accordance with the data use agreement terms and conditions, compliance with the data use, and a plan to house the data in a secure workstation, including following CDC-DRC data transfer protocol was ensured.

Independent variables

The independent variables were Age at enrollment, Sex, Province, Rurality/Urbanicity and Viral load. Patient sex, with the categories, "male" and "female," and age at the time of the start of ART are demographic variables, while the province of health facility location (Haut-Katanga and Kinshasa) and rurality/urbanity status of the health zone are geographic variables. The variable rurality/urbanity consisted of three categories based on the health zone "rural," "Semi-rural/Semi-urban," and "urban," as identified by the population density in cities or towns within the zone (Shah et al., 2021b). These independent variables were coded based on numerical values as follows: 1= 'Urban', 2= 'Rural' and 3= 'Semi-rural/ Semi-urban.'

Age at enrolment in ART was recoded into the following categories: <18 and \geq 18. The clinical variable Viral Load Suppression was categorized as a dichotomous variable <1,000 copies/ml (suppressed) vs \geq 1,000 copies/ml (not suppressed) (Shah et al., 2021b).

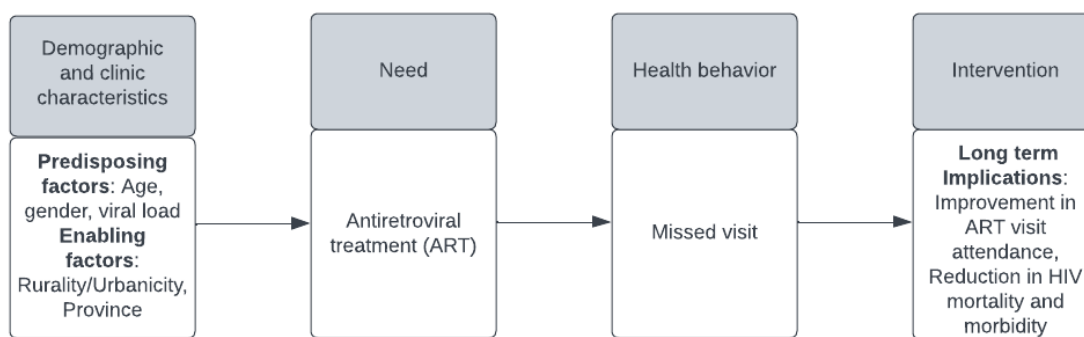
Dependent Variable

The dependent variable was missed clinical care visits for HIV/AIDS among PLHIV (aka missed visits) for HIV/AIDS. In this study, the variable missed visits indicated unmet need or treatment interruptions was defined as scheduled appointments that were not attended. The variable “missed visits” was assessed within a 12-appointments schedule and was coded based on the numerical values as follows: No (0), Yes (1) where ‘Yes’ represents at least one missed visit in 12 months and ‘No’ represents no missed visit.

Conceptual Framework

The conceptual framework describes the relationship between predisposing factors age, gender, viral load, enabling factors- rurality/urbanicity, province, needs, health behavior and health outcome-missed visits which ultimately leads to improvement in treatment attendance and reduction HIV/AIDS related mortality (See operational definitions in Chapter 1).

Figure 3.1: Hypothetical model of the study.



Data Analysis

Descriptive statistics for independent and dependent variables, including means, standard deviation, counts, and frequencies were calculated. Descriptive statistics for continuous variables were presented as means and standard deviation (SD). Categorical variables were tabulated using frequency and percentage. Covariate selection was informed by the Gelberg-Andersen Behavioral Model for Vulnerable Populations and aligned with enabling and predisposing factors outlined by the model (Figure 2), (Stein et al., 2007; Haley et al, 2014) and the review of relevant literature identifying factors associated with missed visits (Haley et al, 2014). Bi-variate analyses using chi-square was conducted. Factors that predicted missed visits for HIV medical care (a dichotomous variable) were analyzed using multivariable logistic regression analysis. The results of logistic regression analyses were presented as adjusted odds ratios (aORs) and 95% confidence intervals (CIs), and statistical significance was defined as a p-value of less than 0.05 in the foot notes. Logistic regression was the preferred method, because it is used to analyze relationships between our dichotomous dependent variable (Missed visit: Yes/ No) and dichotomous independent variables (Demographic and clinical characteristics). The findings are presented as graphs. All data management and statistical analyses were performed using SAS software version 9.4 (SAS Institute Inc., Cary, NC, USA).

Ethics

Authorization to use this data was obtained from CDC/DRC. IRB approval was obtained from Georgia Southern. An exemption from review by the Institutional Review Board was obtained as the data is already de-identified.

CHAPTER 4

RESULTS

This chapter presents the information collected from descriptive and multivariable logistic regression analysis of data on PLHIV receiving ART. The purpose of this research was to examine the demographic and clinical characteristics predicting missed clinic visits among HIV patients receiving ART. This data was used because it furnished variables that were needed to answer the questions in this study.

Descriptive Statistics

The descriptive statistics for all dependent and independent variables are listed in Table 4.1. A total of 5338 PLHIV were included in this cohort. Only 329 (6%) patients experienced at least one missed visit while 5009 (94%) experienced no missed visits. The number of missed visits (missed visit count) ranged from 0 to 11. The mean age at the start of ART for PLHIV that experienced missed visit was 36 years of age (standard deviation [SD] = 14) and PLHIV ranged in age from 0 to 46. The mean viral load for PLHIV that experienced missed visit was 22250 copies/ml.

PLHIV that had a viral load greater than or equal to 1000 copies/ml (20%) were a small proportion of the study participants. Those that were from semi-rural (76%) were a greater proportion of the study participants compared to rural (18%) and urban (6%), and regarding age, older PLHIV ≥ 18 years (89%) were a greater proportion of the study participants, as shown in Table 4.1.

Table 4.1

Descriptive Statistics of Missed visits in Kinshasa and Haut-Katanga (N=309)

Characteristics	Frequency	Percent (%)
Mean age = 36 years		
Age		
<18 years old	520	11
≥18 years old	4818	89
Province		
Kinshasa	1851	35
Haut-Katanga	3487	65
Biological sex		
Male	1590	29
Female	3748	70
Rural-Urban		
Urban	326	6
Rural	952	18
Semi-rural	4060	76
Mean Viral Load = 22250 copies/ml.		
Viral Load		
<1000 copies/ml	4270	80
≥1000 copies/ml	1068	20

In Kinshasa province, among PLHIV who had missed clinic visits, 93% were ≥ 18 years old, a larger proportion (76%) were females, the greatest proportion of PLHIV (91%) were semi-rural and 82% had a viral load <1000 copies/ml as shown in Table 4.1. In Haut-Katanga province, among PLHIV who had missed clinic visits, 94% were >18 years, females comprised a greater proportion (70%), PLHIV from semi-rural (83%) were a greater proportion of the study population and patients with viral load <1000 copies/ml (78%) were a greater proportion of the study population (See supplemental tables).

Chi-Square tests of association showed that of the variables analyzed, only Rural-Urban and Age at start of ART had a statistically significant relationship with missed visit ($P < .0001$, 0.04 respectively) as shown in Table 4.2.

Table 4.2

Distribution (number and percent) of missed visits by PLHIV characteristics in Kinshasa and Haut-Katanga Province.

Characteristic	Missed visit =No N=5009	Missed visit=Yes N=329	P-value
Mean age = 36 years			
Age			0.04
<18 years old	542(96%)	24(4%)	
≥18 years old	4467(94%)	305(6%)	
Province			0.6
Kinshasa	1741(94%)	110(6%)	
Haut-Katanga	3268(94%)	219(6%)	
Biological sex			0.4
Male	1499(94%)	91(6%)	
Female	3510(94%)	238(6%)	
Rural-Urban			<.0001
Urban	320(98%)	6(2%)	
Rural	910(96%)	42(4%)	
Semi-rural	3779(96)	281(7%)	
Mean Viral Load = 22250 copies/ml			
Viral Load			0.8
<1000 copies/ml	4009(94%)	261(6%)	
≥1000 copies/ml	1000(94%)	68(6%)	

Note. P=0.05, C.I = Confidence Interval

Multivariable logistic regression analysis

In multivariable logistic regression analysis, age and rural-urbanicity were significantly associated with missed visits as shown in Table 4.3 There was no significant association between biological sex, province and viral load and missed visits as shown in Table 4.3.

PLHIV from Haut-Katanga province had higher odds of missed visits compared to patients from Haut-Katanga province (AOR=1.18, 95% CI [0.93,1.49]). PLHIV from rural areas had higher odds of missed visits compared to patients from rural areas (AOR=2.60, 95% CI [1.10–6.197]).

PLHIV from semi-rural areas had higher odds of missed visits compared to patients from urban areas (AOR=4.21, 95% CI [1.85–9.58]). Females had higher odds of missed visits than males (OR= 1.07, 95% CI [0.83–1.37]). Older PLHIV had higher odds of missed visits (OR= 1.56, 95% CI [1.01–2.4]) as younger age was protective against missed visits. Also, PLHIV with viral load greater than 1000 copies/ml had higher odds of missed visits (OR=1.14, 95% CI [0.86–1.51]) as viral suppression was protective against missed visit. The fitness of the logistic regression model was shown by the Hosmer–Lemeshow goodness-of-fit test.

Table 4.3

Multivariable logistic regression adjusted odds of missed visits by demographic and clinical characteristics (N=5338).

Characteristics	Odds Ratio	95% C. I		P-value
		Upper	Lower	
Age				0.04
≥18 years old	1.56	2.401	1.012	
<18 years old	...	...	...
Biological sex				0.60
Female	1.07	1.372	0.831	
Male	...	...	...
Rural-Urban				
Rural	2.60	6.197	1.091	0.37
Semi-rural	4.21	9.58	1.854	<.0001
Urban	...	...	...
Province				0.18
Haut-Katanga	1.18	1.493	0.927	
Kinshasa	...	...	...
Viral Load				0.35
≥1000 copies/ml	1.14	1.513	0.864	
<1000 copies/ml	...	...	...

Note. P=0.05, C.I = Confidence Interval

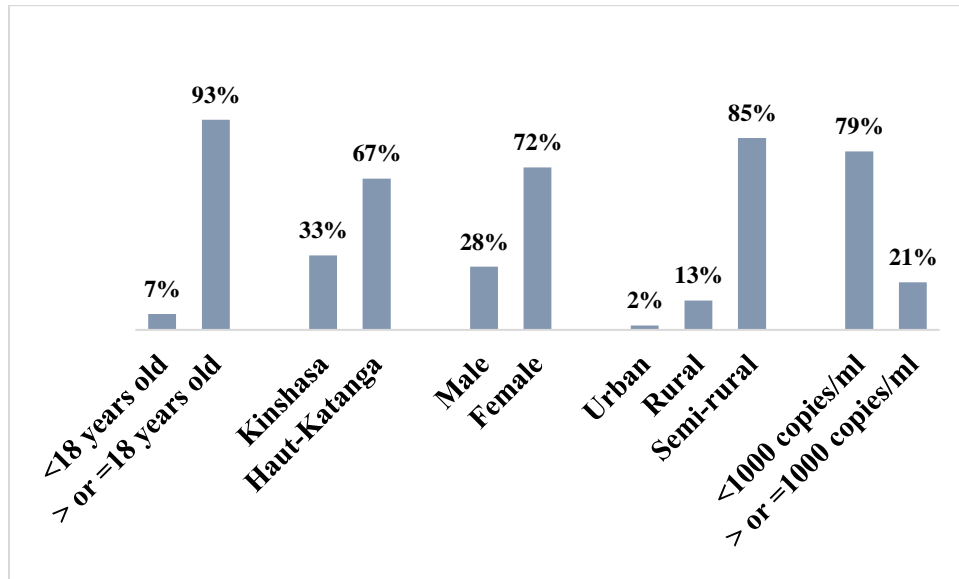
Table 4.4

Summary of the research hypotheses and whether they were rejected.

Research Hypothesis	Supported	Not Supported
H11: There is a difference in missed clinical visits between male and female PLHIV		X
H21: There is a difference in missed clinical visits between young PLHIV and those of older ages.	X	
H31: There is a difference in missed clinical visits between HIV-infected patients with higher viral load and those with lower viral load		X
H41: There is a difference in missed clinical visits between PLHIV receiving care in the Kinshasa treatment center and those receiving care in the Haut-Katanga treatment center.		X
H51: There is a difference in missed clinical visits between PLHIV receiving care in rural health zones and those residing in urban health zones.	X	

Figure 4.1

Missed visit by Age at start of ART, gender, province, rurality/ urbanicity, and viral load.



CHAPTER 5

DISCUSSION

This chapter provides a discussion of the findings of the present research. In the present study, the dichotomous variable whether at least one visit was missed in the past 12 months, labeled as “missed visits” was operationalized as a dependent variable, whereas the age, gender, viral load, and rurality-urbanicity were taken as independent variables. The impact of clinical and demographic variables on missed visits among PLHIV receiving antiretroviral treatment was studied.

This study showed an association between age and missed visits. Younger PLHIV (age <18 years), were less likely to experience missed visit compared to older PLHIV. One plausible explanation for this finding could be that young PLHIV may have greater support and structure via the family environment in comparison to older PLHIV (Tarantino et al., 2018) which could foster early HIV diagnosis and engagement in HIV care among younger PLHIV compared to older PLHIV. Family-centered care that involves the family in the care and treatment of HIV-positive children can help to ensure that children are supported and that families are empowered to help their children stay healthy. Findings of the present contrast the previous study that showed, older age was protective against being missing from care (Nijhawan et al., 2017).

There was no association between biological sex and missed visit in this study. In the DRC, women have more points of entry to care and are more likely to seek care. Thus, their familiarity with more service points providing care may also improve their chances of early referrals to HIV prevention and management programs. Contrasting results were also shown in literature as regards the role sex plays in missed appointments for PLHIV. While males were more likely to experience some discontinuity in care (Batey et al., 2021), other studies have showed that being female was

associated with missed visits (Jiamsakula et al, 2018, Kay et al., 2019). Programs targeting both male and female PLHIV may be beneficial. Male peer individual or group initiatives should be made available and accessible to males in the DRC, particularly in high-risk groups such as men who have sex with men (MSM), sex workers, and people who inject drugs.

Rural-urbanicity, was significantly associated with missed visit in this study. Patterns of care-seeking in this setting is driven by the severity of illness, with the sickest rural residents seeking care in urban areas (Shah et al., 2022). In addition, rural communities are often more closely knit, hence, the social stigma often associated with HIV may motivate the sickest rural residents to seek HIV care from urban centers away from their communities. On the other hand, Urban PLHIV have been shown to have more options and may move more frequently to other clinics, interrupting their care. In semi-rural areas, the trend is for the sickest PLHIV to move to urban areas with better-equipped and better-staffed facilities (Shah et al., 2021b). These moves can be complicated by the absence of interoperable patient information systems which can track PLHIV when they shift between treatment centers between rural and urban areas. Previous studies in DRC showed a diffusion of HIV prevalence from urban to rural areas (Carrel et al., 2016) while a recent study in DRC by Shah et al., 2021a, showed that the odds of treatment retention were higher for PLHIV receiving ART at urban clinics (Shah et al., 2021a). Additional insight to the impact of semi-rural and semi-urban on missed visits among PLHIV is offered by this study which previous studies on missed visits have not considered.

Still on the impact of geographic variables predicting missed visits, there was no significant association between province (Kinshasa and Haut Katanga) where HIV care was being received and missed visits in this study. This further confirms the previously mentioned

health seeking behaviors of PLHIV in the DRC. Haut Katanga and Kinshasa are two different regions in the Democratic Republic of the Congo (DRC) that differ in various ways.

Haut Katanga is a rural province in the southeastern part of the country, known for its mineral-rich resources, particularly copper and cobalt. It is home to the city of Lubumbashi, the second-largest city in the country, and a major economic center. Haut Katanga has a diverse population, with many ethnic groups represented, including the Luba, the Lunda, and the Bemba. On the other hand, Kinshasa is the capital city of the DRC, located in the western part of the country. It is the largest city in the country, with a population of over 15 million people, and serves as the political and administrative center of the country. Kinshasa is known for its vibrant music and arts scene, with various cultural and entertainment venues. In terms of demographics, culture, and economic activity, Haut Katanga and Kinshasa are quite different. While Haut Katanga is known for its mining industry and diverse population and largely rural, Kinshasa is a bustling urban center with a vibrant arts and entertainment scene.

Viral load prior to the start of ART is generally considered an important factor predisposing PLHIV to missed visits in this study. However, there was no association between viral load and missed visits in this study. Although conforming to the treatment schedule is known to improve viral load suppression, the risk of therapy interruptions increases with longer duration on ART, particularly in resource-challenged environments associated with patient- and/or program-related challenges (Shah et al., 2021b). Failure to initiate treatment upon diagnosis could encourage treatment interruptions. For example, historically, protocols required a CD4 test before ART initiation. (Shah et al., 2021b). Same-day ART diagnosis and treatment initiation strategy is currently being implemented in DRC as part of the “95-95-95” guidelines by UNAIDS removing the need for a CD4 test before ART initiation.

Previous studies in the United States and Asia, showed PLWHIV with a lower CD4 cell count hence, a higher viral burden were more prone to missed visits (Horberg et al., 2013; Zhang et al., 2012; Jiamsakula et al., 2018). However, this could be limited by the type of study. For example, qualitative research from Malawi, has suggested otherwise and shown that the experience of a positive change in one's health, especially being virally suppressed could lead to a better perception of one's health prompting defaulting habits towards treatment (Chirambo et al, 2019). This suggests the need to employ diverse methodology to understanding the impact of viral load on missed visits.

A comprehensive support system linking and coordinating existing services is imperative in addressing missed visits in DRC. An example is the Community ART groups (CAG) support groups which plays a key role in defaulter tracing and encouraging attendance at health facility appointments. CAG members also organize themselves to meet and provide peer support without the involvement of the health providers. Peer support groups also provide psychosocial component of care and address the stigma that PLHIV face. Building community capacities to provide support will ensure sustainability, continuity of interventions, and community development.

Another strategy that has been shown to work in this setting is the decentralized drug distribution (DDD) models where ART patient can receive their medication refills in a community setting instead of at the health clinic. Multi-month dispensing may also increase the chances of retention in care and prevent missed visits because compliant PLHIV do not need to return often to the facility for medication pick-up. Interventions that include longer periods between ART refills (i.e., multi-month dispensation), home delivery of ART refills, linkage to social service support programs after diagnosis, and "silent" transfer of care between clinics for

PLHIV relocating (e.g., due to change in employment) are all possible successful strategies for increasing retention in care (Shah et al., 2021b) preventing the potential for missed visits. Shorter travel time to health facilities can lower the occurrence missed visits. Tele-health visits in addition to DDD may see reduction in frequency of missed visits due to geographic location.

Data linkage with community support system databases may also reduce the risk of missed visit. Maintaining interoperable patient information systems, and ongoing data linkage to detect the PLHIV who show early suboptimal commitment to their HIV care and hence can receive assistance through the community services is a promising approach. Information sharing could enable transfer of responsibility for follow-up of PLHIV who are transferred out to other health centers. Capturing as much contact information as possible during the initial visit, updating patient contact information at every opportunity have been suggested in the literature for enhancing retention (Shah et al., 2021b).

It's important to build systems to assess the relative cost-effectiveness of different strategies developed to reduce missed visit in the face of shrinking resources. For example, access to internet services for telehealth services which is still a challenge even in developed countries may be a challenge in rural areas in resource poor settings such as DRC.

Six percent of PLHIV missed their treatment in this study which indicates more work still needs to be done. Continuous evidence-based quality control improvement is required to reduce the prevalence of missed visit in DRC. The demographic characteristics age and rural-urbanicity distinguished our study on missed visits in the multivariate model. The predisposing characteristics from the theory included age, gender and viral load while rural-urbanicity and province, represented the construct of enablers from the Gelberg-Andersen Behavioral Model. The findings from this study raise the importance of patient tracking systems, across rural and

urban settings to ensure that PLHIV's propensity to attend/miss clinic visits is captured. Visit attendance over the past year represents a promising simple approach to characterizing risks in the treatment continuum for PLHIV. Proactive interventions to address missed visits need to assess and address demographic barriers to care and the allocation of resources targeted to those at the highest risk of missed visits.

Public Health Implications

Missed visits for HIV care in DRC have serious public health implications. Consequences of missed visits for HIV care are enormous however, are addressable. This study offers the use of a socioecologic approach to understanding the various angles to missed visits through a look at risk factors from the individual, community, organization/systems and policy levels. Therefore, approaches to addressing missed visits for HIV care in DRC need to be wholistic in this regards.

Existing policies that promote engagement of PLHIV in care can be strengthened through strategically designed innovations in healthcare services, with collaborations with community partners for referrals, addressing stigma and discrimination related to HIV, and HIV transmission and drug resistance within communities. The social support and community mobilization and healthcare navigation approaches for the management of HIV/AIDS, as opposed to individual-level approaches alone, have been shown to improve antiviral medication adherence. It is important that there are educational interventions designed to improve HIV knowledge and treatment adherence.

Real-time surveillance of the HIV care for PLHIV and evaluation of programs such as this study, can ensure maximizing the use of limited resources. The ability to track in real time, and respond effectively to individuals at risk of missed care ensures that PLHIV are able to

access the care and support they need to manage their condition effectively. These are desirable strategies to ensure DRC is able to accomplish UNAIDS' 95-95-95 targets of 95% of all people receiving ART to have viral suppression and working towards the elimination of the AIDS epidemic.

Limitations

This research has several limitations. While several key patient-level characteristics were controlled for in analyses, there may be unexplained, uncaptured variance related to unmeasured characteristics. Psychosocial factors or psychiatric conditions have been suggested to elevate the risk of missed visits for HIV medical care, but this study did not evaluate such factors. Although the sample included over 5000 patients from two CDC-affiliated clinics hence, using a venue-based sampling, the findings may not be generalizable to PLHIV at other clinics or in other states/regions. The findings may also not be generalizable to community health care centers, rural clinics, or clinics outside of this setting (Kay and Westfall, 2020; Haley et al., 2014).

The use of baseline measures as predictors did not allow for the test for associations between changes in predisposing or enabling characteristics and the likelihood of study visit nonattendance over time. Further, strategies used by these health centers to prevent missed visits were not assessed. Lastly, these data, although detailed, are strictly quantitative and therefore do not provide information about the “why” of missed clinic visits, including patient and provider perspectives (Nijhawan et al., 2017). Despite the study's limitations, the study's finding has implications for the care of HIV infected individuals in the Democratic Republic of Congo. Although this study is observational and retrospective it does reflect real world clinical practices. This study will substantially add to the literature that addresses adherence to HIV services and care utilization and provides relevant data to inform future interventions in similar HIV clinic settings.

Recommendations for future research

Future research could examine missed visits using qualitative data which would be useful to answer questions regarding the “Why” and “how” of missed visits among PLHIV. Future research should consider exploring the association between psychosocial factors and the risk of missed visits for HIV medical care. Other factors that may influence missed visits such as comorbidity, pregnancy and methods used by health centers to combat missed visits need to be included in future data collection for PLHIV.

Conclusion

There is evidence of associations of patient demographics with missed visits in HIV care that may be beneficial for improvements in HIV services in DRC. This study showcased the Gelberg-Andersen Behavioral Model for vulnerable populations which describes how certain populations may face specific vulnerabilities and significant barriers in obtaining health care. Public health programs involved in providing care to individuals with HIV/AIDS in the Democratic Republic of Congo should not only focus on decreasing the rates of missed visits for antiretroviral treatment, but also understand differential risk of missed visits among subgroups population such as females, adults, PLHIV with higher viral load (>1000 copies/ml), and PLHIV who resided in rural areas who are remarkably at higher risk of missed visits. The study findings have implications for policy and interventions targeting PLHIV at higher risk of missed visits to ensure retention in care, reduce HIV transmission and ultimately improve survival rate of PLHIV in the Democratic Republic of Congo.

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Appendix

Supplemental tables:

Table 4.5

Missed visit count

Missed visit count	Frequency	Percent (%)
0	5009	93.84
1	78	1.46
2	69	1.29
3	42	0.79
4	32	0.6
5	26	0.49
6	19	0.36
7	22	0.41
8	10	0.19
9	14	0.26
10	11	0.21
11	6	0.11

Table 4.6

Descriptive Statistics of Missed visits (Missed visit=Yes) in Kinshasa Province

Characteristics	Frequency	Percent (%)
Age		
<18 years old	11	10
≥18 years old	99	90
Biological sex		
Male	26	24
Female	84	76
Rural-Urban		
Urban	-	-
Rural	10	9
Semi-rural	100	91
Viral Load		
<1000 copies/ml	90	82
≥1000 copies/ml	20	18

Table 4.7

Descriptive Statistics of Missed visits (Missed visit=Yes) in Haut-Katanga Province

Characteristics	Frequency	Percent (%)
Age		
<18 years old	13	6
≥18 years old	206	94
Biological sex		
Male	65	30
Female	154	70
Rural-Urban		
Urban	6	3
Rural	32	15
Semi-rural	181	83
Viral Load		
<1000 copies/ml	171	78
≥1000 copies/ml	48	22

Table 4.8

Descriptive Statistics of Missed visits (Missed visit=Yes) in Kinshasa and Haut-Katanga

Characteristics	Frequency	Percent (%)
Mean age = 36 years		
Age		
<18 years old	24	7
≥18 years old	305	93
Province		
Kinshasa	110	33
Haut-Katanga	219	67
Biological sex		
Male	91	28
Female	238	72
Rural-Urban		
Urban	6	2
Rural	42	13
Semi-rural	281	85
Mean Viral Load = 25859 copies/ml		
Viral Load		
<1000 copies/ml	261	79

≥ 1000 copies/ml

68

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