

2020

Retention, Viral Suppression, and Care Models in HIV Positive Children and Adolescents in Cameroon

Eveline Mboh Khan
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Walden University

College of Health Sciences

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Walden University
2020

Abstract

Retention, Viral Suppression, and Care Models in HIV Positive Children and
Adolescents in Cameroon

by

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MSc, London School of Hygiene and Tropical Medicine (LSHTM), 2011

BSc, University of Buea, Cameroon, 1998

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health (Epidemiology)

Walden University

November 2020

Abstract

Human Immunodeficiency Virus (HIV) remains a significant public health problem in Sub-Saharan Africa with poor treatment outcomes in children and adolescents (C&As). There is a lack of information on the effects of various HIV care models (Child and Adolescent Friendly Clinic model and Support Group model) on retention in care and Viral Suppression (VS) in Cameroon. This study was carried out to identify the care model with the best outcomes for C&As, inform national scale-up strategies, resource prioritization, and contribute to the existing literature. A quantitative retrospective cohort review approach guided by the social cognitive theory was used to analyze data on 2,503 C&As aged 0-19 years current on antiretroviral therapy (ART) from January 2018 to September 2019 with a documented viral load result. Data were analyzed using multiple logistic regression and the Kruskal-Wallis one-way analysis of variance tests, and findings were interpreted using the test statistics and p values. The retention at 12 months was not associated with the model of care (OR = 1.014, $p = .876$). Viral Suppression and medication pickup were not associated with the type of home-based caregiver. The Odds of VS were 1.265 times higher in C&As enrolled in the Child and Adolescent Friendly Clinic model compared with the Support Group model ($p = .003$). Consequently, this research's findings will impact positive social change by stimulating further studies leading to quality improvement in the HIV domain. Moreover, the results could encourage public health professionals to design and implement effective HIV management programs addressing clinical and psychosocial services needed to improve retention and VS for C&As.

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Dedication

I dedicate this dissertation to my late Dad, Pa Alexander Mbo, and my late grand mum, Ma Rebecca Ngwi, who instilled the spirit of hard work in me when I was young, encouraging me to study hard, though being a girl. Pa Alex, you taught me how to work hard for anything I engage in doing and did not listen to the advice of some of your friends who saw no value in education for female children. Grand Ma, you always blessed me with good wishes, saying I will study to the highest level and go abroad for education. I have gone, studied, and achieved. I know that you both feel happy and proud of me where you are. Continue to rest in peace and may the Lord Almighty be praised for this outstanding achievement.

Acknowledgement

I sincerely appreciate my committee members Dr. Adebowale Awosika-Olumo (Chair) and Dr. Tina D. Cunningham (Member), as well as Dr. W. Sumner Davis (URR) for their relentless guidance, timely feedback, and encouragement throughout this dissertation journey. I also acknowledge all my tutors especially Dr. Banerjee (Dr. B) who in addition to teaching also provided inputs on my prospectus and Dr. Scott Burrus who taught me Advance Quantitative Reasoning and Analysis. Thank you both for being such great teachers.

I could not have completed this work without the continuous support and encouragement of my supervisor and mentor, Prof. Tih Pius Muffih who reminded me sometimes at midnight to submit my assignments. I also appreciate my in country co-supervisor, Prof. Anne Bissek for all her support and encouragement. My appreciation also goes to my colleagues including Ms. Awa Piaplah Cynthia who assisted me during data collection, Mr. Monju Johnson, Dr. Kum Walters, and Mrs. Amah Ophelia who continuously gave me encouragement throughout the study period.

I appreciate all my family members and friends for the support, encouragement, and prayers. Specifically, my heart goes to my uncle, Daddy Fet Aloysius Sama who checked on my progress always and celebrated every milestone I achieved. My sincere appreciation also goes to my beloved husband, Bernard Asongwe Nyindem, my two sons, Ryan Afanwi and Alexis Fon, my mum, Juliana Sirri, who all had to sacrifice a lot of family time and kept long nights just to encourage me to complete my assignments and my dissertation. I thank God for bringing you all into my life and love you endlessly.

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Chapter 1: Introduction to the Study

Introduction

This study was carried out to identify the model of care among the three used in the field that offer the best retention and viral suppression rates in children and adolescents (C&As) on antiretroviral therapy (ART). The findings will inform human immunodeficiency virus (HIV) stakeholders on the strategy to invest time and resources as they seek higher viral suppression rates in C&As. There is currently a lot of investment in all three models. Still, viral suppression rates for this population remain lower than 70% (CAMPHIA, 2018). This study equally can promote program effectiveness leading to positive social change among national decision makers and program implementers in Cameroon, which is in line with the mission of Walden University.

This chapter includes a statement of the social and research problems based on existing literature, the study purpose, the research questions, hypotheses, the theoretical framework, the nature of the study, the variable definitions and data collection method, assumptions, scope/delimitations, limitations, significance, and positive social change implications.

Background

HIV remains a significant public health problem in several countries in the sub-Saharan African (SSA) region (Abrams et al., 2016). There is still no cure for HIV, but the use of ART has dramatically reduced HIV-associated morbidity and mortality in people living with the virus in SSA (Haas et al., 2019; Kukoyi et al., 2016). Cameroon is one of the countries in the SSA region with many unidentified people living with HIV

and low HIV viral suppression rates among those on ART. According to the Cameroon Population-Based HIV Impact Assessment conducted in 2017, only 46.9% of those living with HIV aged 15 to 64 years knew their HIV status, whereas 80.0% of those in the same age group on ART had viral suppression (CAMPHIA, 2018). These statistics are much lower for children living with HIV in Cameroon as only a small proportion of them are on ART (Penda et al., 2019). Those on ART have low viral suppression rates than adults (Billong et al., 2016a). Identifying and scaling up high-impact strategies for managing C&As living with HIV may hasten the progress towards an HIV-free generation.

People living with HIV need to stay in care and adhere to treatment to achieve viral suppression. Adherence is crucial for treatment success (Mimiaga et al., 2018) and is a significant challenge in the SSA region (Mazenga et al., 2017). Adherence to ART is a more substantial challenge in children and youths who need additional support from their parents or caregivers (Closson et al., 2019). People who are not regular in HIV care cannot be adherent and are likely to have poor treatment outcomes, usually assessed by measuring their viral load (El-sadr, Rabkin, Nkengasong, & Birx, 2017). Cameroon has recorded significant strides in the fight against HIV, reducing the national prevalence from approximately 10% in early 2000 to 3.7% in 2018 (CAMPHIA, 2018). However, the first semester national report of 2017 showed a continuous increase in HIV positive cases identified and initiated on ART. It also showed significant gaps in the ART initiation rate for those tested HIV positive, low uptake of viral load testing, and suboptimal viral suppression rates (NACC, 2017). Various factors account for the low

retention rates, poor adherence, low viral suppression rates, and treatment failure, including the strategies used to deliver the patients' services.

The national HIV program in Cameroon has recorded low rates of ART initiation and retention in HIV care through the years. A cross-sectional study that assessed retention in HIV care for a 1-year cohort of patients from 56 sites in the country's 10 regions found a 60% retention rate at 12 months (Serge Clotaire Billong et al., 2016a). According to the national programmatic reports of 2017, only 49.5% of the expected number of people diagnosed with HIV were on ART, and retention in HIV care was between 76.6% and 79.2% (NACC, 2017). The national report contained data from all 10 regions of the country and was representative of Cameroon's situation, though with internal variations across geographic areas. Figure 1 shows an estimated 561,107 people living with HIV in Cameroon in 2017, but only 58.4% knew their HIV status, and only 49.5% of those who knew their status were on ART.

Figure 1

The HIV Treatment Cascade by 2017 in Cameroon (adapted from the first Semester

National Report of 2017)

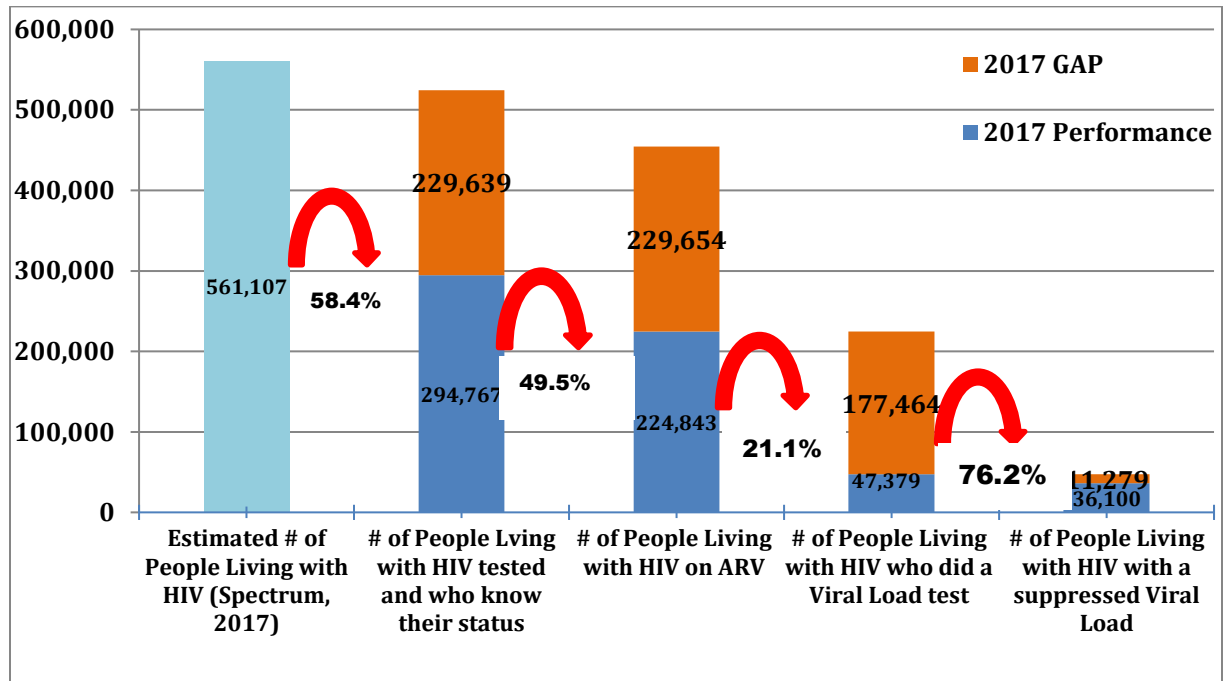


Figure 2

The 12-month retention rates in selected cohorts of people on ART in Cameroon in 2017

(adapted from the first Semester National Report of 2017).

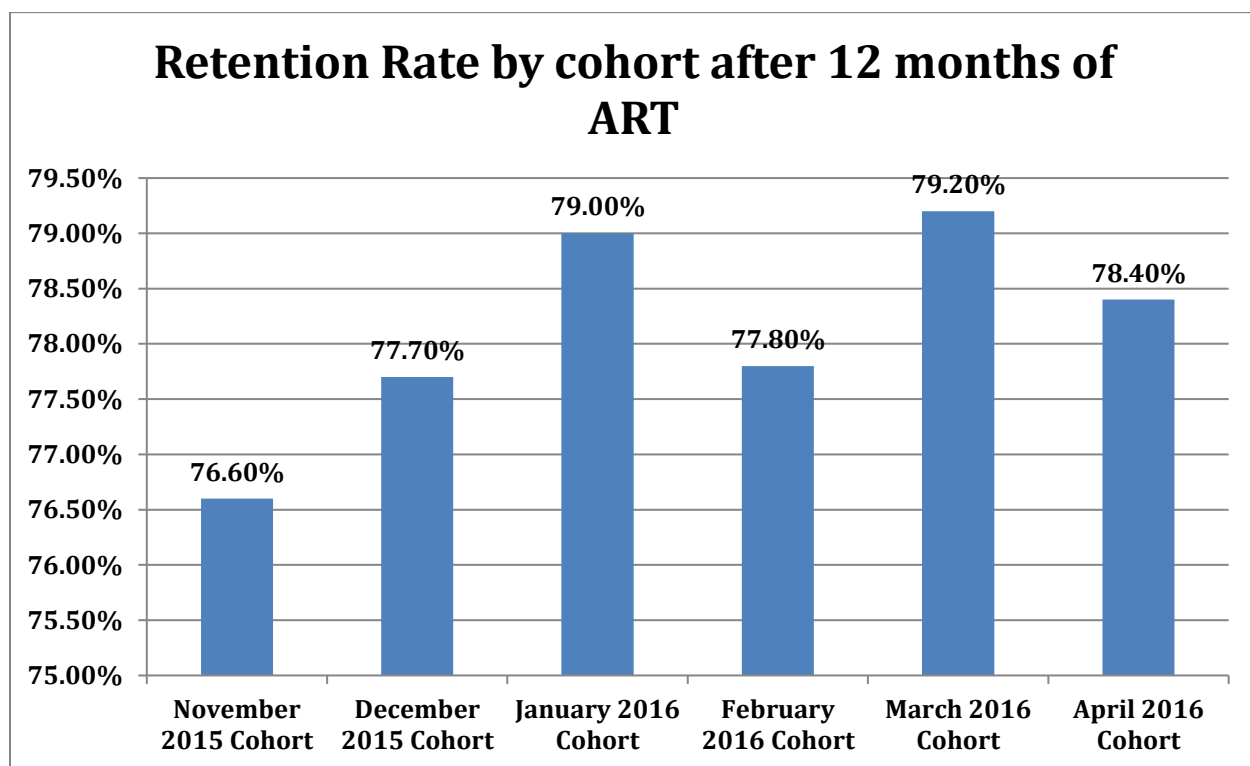


Figure 2 shows evidence that none of the six cohorts monitored after 12 months on ART had up to 80% retention rate, which indicates the failure to achieve the 90% United Nations AIDS (UNAIDS) viral suppression target for the country (UNAIDS, 2014). Evaluating the national program to identify and address major gaps in HIV case identification and retention in care inevitable if Cameroon desires to achieve the UNAIDS 90 90 90 targets.

Until 2018, the uptake of viral load testing was low in Cameroon, and the viral

suppression rates for those who did the test were less than 90% (CAMPHIA, 2018). A study to estimate the national viral suppression rate using a nationally representative sample found 72% viral suppression for a cohort of patients 12 to 24 months after ART initiation and 68% for another cohort 48 to 60 months after ART initiation (Tchouwa et al., 2018). This study also found out that patients with unsuppressed viral load in Cameroon had high indications for HIV drug resistance, which was already identified in previous studies (Billong et al., 2012; Billong et al., 2013; Billong et al., 2016b). The national report of 2017 presented a viral suppression rate of 76.5% for the country. Unfortunately, the various papers and national reports did not report children's specific suppression rates, which indicated limited attention to this subpopulation. These findings confirm the urgency for research that focuses on C&As precisely and the need for identifying implementation strategies that yield maximal results to reduce the likelihood of treatment failure in C&As.

The Vulnerability of C&As

C&As fall into the group of vulnerable populations. They are generally dependent on their parents or caregivers for their health and well-being (Enane et al., 2018b). C&As are more vulnerable to infections because they have no power to control where they live, what they eat, and their community interactions. They are equally more likely to default from HIV care since HIV infections may reduce their immunity, making them more vulnerable to other infectious and health hazards than non-HIV infected children (Bate et al., 2016; Flanagan, Cunningham, Lewis, Tobin, & Ickovics, 2019). Their increased risk of defaulting from HIV care puts them at a higher risk of being virally unsuppressed and

developing treatment failure (Boerma et al., 2017). They need regular reminders to take their medications and depend on their parents or caregivers for transportation to the clinics for a drug pickup. Some of the parents or caregivers also need constant reminders for a medication pickup as demonstrated in a study of the effect of cell phone calls and messages on the respect of pickup appointments by Bigna, Noubiap, Kouanfack, Plottel, and Koulla-Shiro (2014). Researchers in Asia found out that children who are orphans (not living with their biological parents) are more likely to default from treatment and have poorer outcomes than those living with their biological parents (Huy et al., 2016a). These and many other factors contribute to the lower treatment adherence and retention in care for C&As compared with adults (Closson et al., 2019). The home care provider's effects on HIV treatment outcomes in C&As has not yet been documented in Cameroon.

Models of Care Used to Deliver ART and Keep Children and Adolescents in Care

Various care models have been used to provide ART to C&As in different countries with varying results. For instance, in Zimbabwe, researchers assessed the effect of community-based support for caregivers on virologic failure in children from 6 to 15 years on ART using an open-label randomized control trial. They found out that community support to caregivers showed substantial benefits on viral suppression in children (Ferrand et al., 2017). Another study by Lee et al. (2016) documented higher retention and viral suppression rates in youths attending an environmentally friendly clinic than those attending the regular clinic. A clinical trial assessing the use of a streamlined care model in Uganda and Kenya also showed higher retention and viral suppression rates in the intervention group (Kwarisiima et al., 2017). Some other

researchers in Uganda evaluated the effectiveness of an intensive adherence counseling (IAC) strategy to improve treatment outcomes in 345 C&As from 9 months to 19 years in 15 public health facilities. They found out that only 23% of the children achieved viral suppression after completing the three sessions of IAC within a mean follow-up period of 113 days, which cast doubts on the effectiveness of the strategy (Nasuuna, Kigozi, Babirye, Muganzi, & Sewankambo, 2018). Pediatric care services in Cameroon have used similar strategies in different clinics at different time points. Still, the persistently low viral suppression rates cast doubts on the effectiveness of these models. Most of the studies highlighted demonstrated the efficacy of various care models and innovative strategies, except the Ugandan study. The existing literature did not have any research that compared outcomes among different care models. Comparing viral suppression rates for the Cameroon care models could help prioritize the most successful model for the national scale-up plan. Still, it could also feel a gap in the existing literature in this domain.

Most of the funding for HIV services in Cameroon comes from external sources. According to the 2017 First Semester National Report on HIV activities, 88.3% of all finances used for HIV activities came from external sources with the Global Fund and the American President's Emergency Plan for AIDS Relief (PEPFAR) as major funders (NACC, 2017). A study by Zakumumpa, Bennett, and Ssenkooba (2017) highlighted that global funding for HIV programs is flattening, and countries need to seek alternative funding sources to sustain their HIV programs. In such circumstances, it becomes even more critical to invest only in programs that yield the best effects on the population.

Providing the best care model for patients could save cost, effort, and time. The study sought to identify evidence for the best HIV care model for C&As that could be promoted for scale-up in Cameroon.

Problem Statement

HIV remains a significant public health concern in SSA. Many countries in the SSA region are still far from achieving the UNAIDS ambitious treatment targets for ending the AIDS epidemic in their pediatric and adolescent HIV programs (Elgalib et al., 2018; Enane et al., 2018a; Peter et al., 2017). These targets stipulated that by 2020, all countries fighting to end the AIDS epidemic should identify 90% of all people living with HIV, initiate at least 90% of those identified on treatment, and achieve 90% viral suppression for those on medication (UNAIDS, 2014). Research findings from Cameroon documented alarming unsuppressed viral load levels and low retention in the pediatric and adolescent care cascade (Tchouwa et al., 2018). The inadequate viral suppression indicates the possibility of drug resistance in this subpopulation (Billong et al., 2016). These C&As have undesirable outcomes and high mortality rates (Bigna et al., 2014). They are usually sick, unable to attend school regularly, and often on admission in the hospitals (Bate et al., 2016). Families spend money on hospital bills instead of food and other needs; mothers spend time taking care of sick children instead of fending for their families, increasing their poverty level. Furthermore, the interventions implemented in most countries target C&As in general, but C&As who do not live with their biologic parents have special needs that may affect their retention in HIV care and medication adherence, leading to reduced viral suppression (Huy et al., 2016b).

In the last 5 years, Cameroon has implemented various care models and strategies on a limited scale to improve treatment outcomes for pediatrics and adolescents on ART. For instance, some health facilities in urban and rural settings in the past 5 years used children and adolescent-friendly clinics and support groups to manage C&As living with HIV. The C&As come together monthly to play, share experiences, and receive psychosocial support. However, there was no significant improvement in the outcomes in C&As, especially in the regions where these models were widely implemented according to national reports (NACC, 2014 and 2017). No researcher in Cameroon has evaluated the various HIV care models' contribution to their HIV care retention and subsequent viral suppression. Identifying which of the care models is associated with higher retention in care and viral suppression rates for C&As in HIV care could inform national scale-up strategies and resource prioritization. The results would also contribute to the existing literature on maximizing the outcomes in C&As on ART.

Purpose of the Study

The purpose of this study was to generate evidence on retention in care and viral suppression for the C&As on ART in Cameroon while identifying the care model with the best outcomes. Thus, I compared various HIV care models used to manage the C&As to identify the care model among the three with the best retention in care and viral suppression. I also hoped to establish if the type of care provider at home is associated with retention and viral suppression in C&As on ART in Cameroon. The findings will contribute to the existing literature gap and inform program planning, funding

prioritization, and national program scale-up strategies that promote specific high-impact interventions.

The study used a quantitative retrospective cohort monitoring approach to examine existing information in hospital medical records. The study's primary outcomes were retention in care within 12 months, viral load status (suppressed or unsuppressed), and medication pickup consistency within the 12 months. The exposure variables were the care models used to manage the C&As and their type of care provider at home. The study also included information on possible confounders like age and sex, which were systematically documented in medical records. I hoped to analyze the data and identify which of the care models yielded the best outcomes in Cameroon's routine HIV program and indicate whether C&As living with their biologic parents had higher viral suppression rates than those living with foster parents.

Research Questions and Hypothesis

The study had four main research questions as follows.

Research Question 1(RQ1). Is there an association between the 12 months' retention in HIV care and the HIV care model used for C&As after controlling for age and sex?

Null Hypothesis (*H₀*): There is no significant association between the 12 months' retention in HIV care and the HIV care model used for C&As on ART after controlling for age and sex.

Research Hypothesis (*Ha1*): There is a significant association between the 12 months' retention in HIV care and the HIV care model used for C&As on ART after controlling for age and sex.

Research Question 2 (RQ2). Is there an association between viral suppression and the HIV Care model used for C&As after controlling for age and sex?

Null Hypothesis (*Ho2*): There is no significant association between viral suppression and the HIV care model used for C&As after controlling for age and sex.

Research Hypothesis (*Ha2*): There is a significant association between viral suppression and the HIV care model used for C&As on ART after controlling for age and sex.

Research Question 3 (RQ3). Is viral suppression associated with the type of the home-based care provider (the person who supports the child or adolescent at home) among C&As on ART in Cameroon?

Null Hypothesis (*Ho3*): Viral suppression is not significantly associated with the type of home-based caregiver (the person who supports the child or adolescent at home) among C&As on ART in Cameroon?

Research Hypothesis (*Ha3*): Viral suppression is significantly associated with the type of home-based care provider (the person who supports the child or adolescent at home) among C&As on ART in Cameroon?

Research Question 4 (RQ4). Is there a significant difference in the average proportions of the consistency in medication pickup for the different types of home-based

care providers (the person who supports the child or adolescent at home) among C&As on ART in Cameroon?

Null Hypothesis (*H₀₄*): There is no significant difference in the average proportions of the consistency in medication pickup for the different types of home-based providers among C&As on ART in Cameroon.

Research Hypothesis (*H_{a4}*): There is no significant difference in the average proportions of the consistency in medication pickup for the different types of home-based providers among C&As on ART in Cameroon

Collecting data and analyzing to respond to these four research questions led to achieving the study's objectives. I hypothesized that children enrolled in children and adolescent friendly clinics (CAFCs) will have higher retention and viral suppression than those not enrolled in such social groups. Also, I speculated that children living with their biological parents received better parental care and were likely to have better viral suppression rates than those living with other caregivers. This study generated substantiation, as presented in Chapter 4, either confirming or disproving these hypotheses.

Measurement of Variables

Viral Load Status

According to the nationally approved algorithm, patients on ART are supposed to have a viral load test at least once a year. The viral load is measured in terms of viral copies per milliliter of blood. In Cameroon, the values obtained are classified into three categories: not detectable (0 copy/ml), detectable but <1000 copies/ml, and detectable

with >1000copies/ml. Those not detectable or detectable with <1000 copies are classified as virally suppressed, while those with >1000 copies/ml are virally unsuppressed (Collins et al., 2019).

Retention in Care

Viral suppression was measured by taking the cohort of patients in care at the start of the study period and documenting the number still in care after 12 months. Viral suppression was recorded for the C&As who started treatment within the study period and attained 12 months on ART before December 2019. Retention rates were calculated per care model and findings reported.

Consistency in Medication Pickup

Patients on ART pickup medications each month, and the information is documented in the ART registers against the said month. When they miss picking up medications for a month, space is left blank to indicate a missed opportunity. For this study, the number of months with documentation of medication pickup in the last 12 months will be recorded. The proportions of the consistency in medication pickup will be calculated for each client using 12 months as the denominator and the total number of months the C&As picked medication (as recorded in the ART register) as the denominator and the analysis of the information will generate the responses to the fourth research question.

Care Models

Different health facilities use various care models to manage C&As based on their external support. These care models are different from the differentiated care model promoted by WHO (Graves et al., 201; Prust et al., 2018) in that the model is used for all

the patients and not adapted to individual needs. This study's care models were children and adolescent-friendly clinics, support groups, and standard clinic visits. Sites selection was purposeful, considering the model of care used onsite to have a near equal distribution of participants in the various models.

The Type of Home-Based Care Provider

The type of caregiver supporting each study participant at home was documented and classified into three main categories: (a) both parents; (b) one parent (mother alone or father lone); and (c) foster parents/caregivers who included aunts, uncle, brother, sister, and others.

Possible confounders or effect modifiers with information documented in the client records were age and sex. These two were included because there was data available on them in the registers and because some published studies showed that retention and viral suppression were associated with age and sex.

The Theoretical Framework Guiding the Study

The theory that guided this research was the social cognitive theory (SCT), which was first articulated by Bandura in a book titled *Social Foundations of Thought and Action* (Bandura, 1986). This theory holds that personal factors, environmental influences, and behavior continually interact in a dynamic three-way reciprocal manner (Glanz & Bishop, 2010). The theory has been used to guide interventions that include learning from observations, setting goals to drive behavior change, and reinforcing behavior (Forthofer et al., 2016). It builds on the fact that an enabling environment and personal factors can influence behavior leading to self-efficacy, which is the confidence

in the ability to do things in specific circumstances (Forthofer et al., 2016). C&As constitute a population that is still dependent on their parents and caregivers in terms of where they live, what they eat, financial resources, and, to a great extent, what they know, social protection, and their decisions (Bröder et al., 2017). They need money from their parents or caregivers to go for medication pickup, require information from them on why they are taking the medications, and need reminders when taking the medicines. They are also fast learners and quickly learn and develop the confidence to perform specific tasks when given the enabling environment.

Applying these facts to the study, the SCT was used to explain the parental/caregiver support children receive at home, the therapeutic sessions, play sessions, and enhanced adherence counseling sessions received in the clinics in addition. It was also used to explain the effect of their interactions with the care providers and their peers, which might have influenced their retention in care, adherence to therapy, and viral suppression. Their engagement in all these activities might have increased their understanding of the importance of staying in care (Bröder et al., 2017), improved their self-confidence, and the determination to stay healthy (Forthofer et al., 2016). In line with the hypothesis, C&As enrolled in the care models and living with both parents might have more favorable conditions that improved their social cognitive behavior and ability to stay in HIV care, achieve viral suppression than those living with foster parents.

Nature of Study

Methodology

This study was quantitative, using a retrospective cohort review approach to analyze data on child and adolescents (0-19 years old) who were currently on ART in HIV programs in Cameroon from January 2018 to September 2019. I selected this approach because of the limited cost involved and the convenience of using existing data. The outcome variable's data was quantitative and already existing in health facility registers and patient medical files. The data on exposure variables was categorical data also existing in the medical records. I used a convenient sample of study sites that I purposefully selected following the number of children enrolled in care and the various care models implemented while maximizing a mix of urban versus rural communities, public versus private health facilities, and English versus French-speaking regions. At the sites, all clients on ART aged 0 to 19 years who had been on ART for at least 1 year and had done at least one viral load test were included based on the results documented in the medical records. The records' review allowed the tracking and documentation of demographic information, type of care providers at home, viral suppression status, and other variables. I entered the data into an Excel sheet on the computer, cleaned the data, and analyzed the data using SPSS Version 25.

Study Variables, Data Sources, and Data Analysis

I collected data on numbers of C&As enrolled and with documented viral load results in each participating site and disaggregated the data by care model, age, sex, and type of home-based caregiver. Care models included CAFCs, support groups (SGs), and

standard clinic visits (SCVs). The C&As were divided into four age groups: <5 years, 5 to 9 years, 10 to 14 years, and 15 to 19 years to ease the provision of age-adapted therapeutic education with those in the group of 15 to 19 years considered as adolescents. For this study's purpose, I divided them into two groups with those ≤ 14 years seen as children and those ≥ 15 years seen as adolescents. The type of home-based caregivers included three categories: (a) both mother and father; (b) mother or father alone; or (c) foster parents who included aunt, uncle, grandparents, sister, brother, or others.

Data Analysis Plan

After data cleaning, coding, and transfer to SPSS (v.25), the data analysis began with exploration using various statistics, percentages, and frequencies to examine and present the data. The descriptive analysis findings were presented using frequency tables, some bar charts, and pie charts for categorical variables. I used tables, central tendency measures, and variation measures, such as means, median, standard deviations, variance, range, and confidence intervals, for continuous variables. I used the binary logistic regression model to predict the probability of achieving good retention in care and viral suppression in the three models of care as hypothesized. I also constructed multiple logistic regression models, including the exposure variables and the two possible covariates (age, sex) to assess their effect on the associations between the outcome in the three models of care and caregiver categories. To respond to RQ4, which had a continuous outcome variable, I used the Kruskal-Wallis one-way-ANOVA test to examine the difference in the mean proportions of the consistency in medication pickup recorded for each type of care provider and interpreted the *F* statistic. Finally, I used

appropriate tables to present the results of the inferential statistics. The findings were interpreted using the p -values, alpha, and effect sizes obtained with an alpha of equal to or less than .05 were considered significant.

Study Approval

I obtained approval at various levels before carrying out the study. These included the National Ethics Committee in Cameroon, the Cameroon Baptist Convention Health Board (CBCHB), Institutional Review Board (IRB), the Walden University IRB, and administrative letters of support from the leaders of all the 27 selected health facilities. I needed the approval of the national Ethics Committee in Cameroon because my study involved five of the country's 10 regions. That of the CBCHB was also required because seven of the 27 study sites were CBCHB health facilities. I also had to visit and collect the administrative support letters from all the health facilities involved as a requirement for the study's approval by the National Ethics Committee. After these approvals, I moved onto data collection from the sites using a data abstraction form. I reviewed existing hospital registers and patient files for C&As enrolled in HIV care and extracted data on the variables of interest using the data abstraction form developed for the study. The data abstraction included only codes for the clients and not their names or other identifiable information to maintain confidentiality. I did the data collection personally with support from two trained research assistants who have good experience working with ART registers in HIV clinics to limit any chances for breach of confidentiality while maximizing the quality of the data collected.

Definition of keywords

Retention in care. People who are retained in care consistently respect their medication pickup appointments without missing the appointment date for up to a week. People who neglect their appointment dates for 7 to 90 days are called defaulters, while those who miss their appointment for more than a period of 90 days are referred to as lost-to-follow-up. HIV treatment programs in Cameroon are implementing the differentiated care models which tailor the appointment dates to the needs of specific clients (Boeke et al., 2018). However, most children have monthly appointment dates. Those who belong to the various care models, such as play corners or adolescent clinics, receive their medication on the days for club activities that hold monthly.

Viral suppression. The viral load test is used to assess the level of HIV in the blood of those living with the virus and measures the number of copies in a milliliter of blood. A blood sample with more than 1000 viral copies per milliliter (ml) of blood is considered virally unsuppressed while that with less than 1000 viral copies/ml of blood is considered virally suppressed (Collins et al., 2019). C&As have lower viral suppression rates (Chime et al., 2018), and patients who are virally suppressed have higher chances of staying healthy and reduced chances of transmitting the virus to another person (Enane et al., 2018b).

Models of care. A care model refers to the service delivery model used to manage the patients. Some C&As in Cameroon attend the regular clinic visits, receive services in groups during age-adapted support group sessions in the clinic or monthly child-play corner activities in the clinic or through monthly adolescent-friendly services organized

by the clinics. In the CAFCs, services providers make sure that C&As receive both clinical and psychosocial care services during group activities while interacting with each other. Children who attend only standard clinic visits miss the peer interaction and therapeutic education provided during the sessions. Some of those who participate in regular clinic visits receive counseling as needed but often limited compared with that offered in the other care models. For this study's purpose, the participants were classified into the three groups coded as SG, SCV, CAFC, and data analyzed by such groups.

The caregiver of C&As at home. The focus of family status was on the people who provide care to the children at home. These could be their two biological parents, single parent, or foster parents. The interest was to see if C&As who live with their two biologic parents had better viral suppression rates than the other children. Each of the study participants fell into one of these three groups.

Antiretroviral therapy. This is the medication given to people living with HIV, which they take daily and will continue taking for life or until when there will be a cure for HIV. Clinicians use various combinations to manage patients depending on the disease stage or viral suppression status and the national treatment protocols.

Children in the study. These are individuals aged from 1 day to 14 years old living with HIV and on ART in one of the selected study sites.

Adolescents in the study. These are individuals aged 15 to 19 years who were living with HIV and on ART in one of the selected study sites.

Medical records. These included national registers in the clinics in which service providers recorded information on essential services offered to the patients following

nationally approved indicators. They included longitudinal information per patient, which the service providers format after every 2 years, given the limited space on the hard copies. Each patient also had a medical file that contained more personalized demographic and medical follow-up information on additional indicators that could not fit into the registers.

Assumptions

This study's key assumption was that the registers and medical files' information would be complete enough to facilitate the data abstraction process. This assumption was not valid in all cases, and it became necessary to use the two documents before obtaining complete data for some patients. This study required complete information on the variables included. I assumed easy access to complete data, which facilitated data abstraction and attaining the required sample size. This study depended on existing information with no access to the participants to verify the information recorded for them. I also assumed that the documented information for each participant in the registers was accurate and reliable. Otherwise, it would have been a waste of time, and findings will not represent the country's situation if the data recorded in the registers and medical files were not accurate.

Scope and Delimitations

I looked at viral suppression status in C&As served through three models of care in Cameroon. I also compared viral suppression rates among the C&As based on their type of caregivers at home. The study was limited to retention, viral suppression, consistency in medication pickup, and the two main exposure variables for the following

two reasons: the C&As were those with the lowest viral suppression rates in the country and high-impact strategies were needed to improve their care and outcomes. Second, some program implementers assumed that the type of home-based caregiver had a significant effect on treatment outcomes for C&As. Bringing out evidence on these two points could significantly contribute to the existing evidence on HIV management in C&As.

This study focused on C&As enrolled on ART through various health facilities in Cameroon. The selection of sites was limited to five of the 10 regions in Cameroon, limiting the generalizability of the findings. The five regions included Center, Littoral, Southwest, Northwest, and West. These involve three French-speaking and two English speaking regions. These regions are those where various care models have been used within the last 5 years in pediatric care and provided the needed sample size. Also, the number of people living with HIV and on ART in Cameroon in these five regions in 2017 represented 76.3% of the total number of people on ART in the entire country (NACC, 2017), which increased the generalizability of the study results.

Limitations

The study was a retrospective cohort study, which has advantages over cross-sectional studies and has limitations. Longitudinal studies do not include the randomization of participants and are, therefore, prone to systematic bias in the assignment of participants in the group (Richards, Brown, Barley, Chong, & Thomson, 2018). The study depended on existing information in medical records, and the significant barrier that might have occurred during data collection was the absence of

complete data in the existing files due to inadequate documentation of services offered. Other variables of interest, such as socioeconomic status or parents' level of income, could not be included because there was no existing information on such variables in the records. These would have been included if the study was prospective in nature. I coordinate HIV activities in various regions and did not have challenges with access to information once the study received approval from the Walden University, facility leaders, CBCHB IRB, and the National Ethics Committee. However, there could be challenges with separating the role of a supervisor from that of a researcher. Conscious of this possible conflict, I ensured to keep a neutral researcher position as much as possible and introduced myself in each facility as a researcher while presenting the various ethical approvals and followed the procedures in place for every researcher collecting data from the facility. The study also focused on those C&As already on ART and those living with HIV who were not yet on ART were left out, whereas some might not be on ART yet due to their family status or type of home-based caregiver.

The significance of the study

There is a need to prioritize health interventions that yield the best results, which have a more significant effect on the population. This prioritization was more critical in settings where there are competing health priorities, and the resources to fight the HIV pandemic are limited (Zakumumpa et al., 2017). This study has the potential to promote positive social change at the decision making and program implementation levels in Cameroon and the SSA region, which is in line with the mission of the Walden University. Findings from this study will fill a gap in understanding which model of care

yields the best outcomes for C&As living with HIV and on ART in routine care settings in Cameroon. These findings may also be useful in other SSA countries with similar HIV care challenges such as Congo, Nigeria, and Ivory Coast (Enane et al., 2018b). The study findings will open other areas for research, given the limited existing literature on some aspects of the study, such as home-based caregivers' role.

The study findings also have the potential to promote social change at the clinic, community, and health system levels as follows:

- At the clinic level, the results will likely increase providers' and parents' understanding of the quality of life of C&As living with HIV, which may enable them to strengthen the care they provide to the C&As both in the clinics and at home.
- At the community level, the study findings may affect the understanding of the actual burden of HIV, the plight of C&As living with the virus, and the support they need from the community to stay healthy and be virally suppressed. For instance, as many more of the C&As living with HIV achieve and sustain viral suppression and live healthy lives, viral transmission rates will be low, they will attend school regularly, their parents and caregivers will spend less money on their health, less time in hospitals, and have more time to work and generate money for other family needs.
- At the health system level, the study findings will inform health stakeholders in Cameroon and other countries with similar challenges during planning, prioritization, and the allocation of the limited financial resources to invest in models of care that yield the best outcomes. These findings will equally inform program implementers to spend time and efforts on the models and strategies that produce the best results and

facilitate the achievement of the third 90 UNAIDS goal in C&As, which aims to have at least 90% of all patients on ART virally suppressed.

Summary

People living with HIV need to stay in care, adhere to treatment, and achieve viral suppression to live healthy lives. In this chapter, I presented an introduction and the background of my proposed study. I also introduced the problem statement and the study's purpose, highlighting the research problem and objective, leading to the research questions I wished to answer by the end of the study. I stated the research questions and the research and null hypotheses that were confirmed or disproved by the study findings, as seen in chapter four. I highlighted the SCT, which grounded the study, and presented the study's nature, which used a quantitative methodology. I equally provided some definitions for key terms, scope, delimitations, assumptions, and discussed the limitations and social change implications. In Chapter 2, I will review and present recent literature on the topic, especially from the SSA region.

Chapter 2: Literature Review

Introduction

Retention in care is still a challenge in the pediatric and adolescent HIV program in Cameroon. Low retention in care leads to poor outcomes increasing morbidity and mortality, and increases HIV transmission in adolescents (Enane et al., 2018a). Although viral load testing coverage is not up to expectation, viral suppression rates for C&As tested remain lower than those of adults. Various care models are used to manage C&As enrolled on ART in various clinics in Cameroon, but the continuous low viral suppression rates put to question these models' effectiveness. Service providers suggest that the C&As have low viral suppression rates because many of them are orphans and do not have their parents as the primary care providers at home. Although no documented evidence compares the performance of the outcomes in these three models of care, there is no evidence for an association between these outcomes and the type of care provider to the C&As at home.

By conducting this study, I aimed to compare retention in care, and viral suppression rates for C&As on ART served through three care models to identify which methods offer the best retention and viral suppression rates. I also aimed to assess the association between the type of care provider at home and viral suppression for the C&As enrolled in this study. This study could generate evidence that will inform the national scale-up of interventions to improve viral suppression rates. The findings from this study could also contribute to the existing literature on the models of care that are most effective in routine care settings and set the basis for further research on the topic.

The current literature contains several studies on retention in HIV care, viral suppression, models of care, and the successes recorded in using them, but no study had compared the outcomes for the various models used in a routine care setting. This chapter contains a summary of existing literature on studies related to HIV and use of ART, retention in care, viral suppression, use of viral load results in patient management, models of care used for C&As, the role of the type of home-based caregiver as well as retrospective studies on the topic. The chapter also contains summary information on the theory that will ground the research and its appropriateness to the topic.

Literature Search Strategies

For this study, I searched the literature for related studies looking through various databases in the Walden University Library and PubMed Central library. The databases search included MEDLINE with text, PsycINFO, and CINAHL Plus with text. I also search ProQuest to see examples of related dissertations and used Google Scholar to look for related articles. Once I found a related article in Google Scholar, I searched for other articles that cited that article to identify more recent literature on the topic. In searching, I used the Boolean approach and the medical subject headings (MESH) to form and search for various combinations of terms such as *HIV AND retention AND viral suppression AND care model OR model of care AND children OR adolescent OR youth OR orphans*. The website of the National AIDS Control Committee in Cameroon (NACC), that of UNAIDS and CAMPHIA, were also searched to identify current statistics on HIV in Cameroon. To find evidence supporting the theory that guided the study, I equally searched for *social cognitive theory OR SCT* in these databases. To access current

literature on the topic, I limited the search to publications of the last 5 years except for the theory where I did not limit the time due to my interest in seeing papers published from the development of the theory. The search in the various databases was also limited to articles published in peer-review journals.

Theoretical foundations

I selected the SCT to guide the conduct of this research. Albert Bandura first articulated this theory in a book titled *Social Foundations of Thought and Action* (Bandura, 1986). As stated by (Mulhollem, 2017), Bandura is considered the most influential psychologist of modern times because his theory combines cognitive, psychosocial, and behavior processing. This theory holds that personal factors, environmental influences, and behavior continually interact in a dynamic three-way reciprocal manner (Glanz & Bishop, 2010). The theory has been used to explain the judgment of somebody's behavior concerning his/her personal standards, self-reaction, and environmental circumstances. It also holds that social behavior is extensively regulated by the exercise of self-influence (Bandura, 1991). Therefore, people should be able to make decisions about their own lives, including C&As. It is further broken down into five key concepts: learning, triadic reciprocal causation, human agency, self-regulation, and dysfunctional behavior (Mulhollem, 2017). The human agency concept includes self-efficacy and self-regulation, suggesting that external and internal factors cause people to regulate their behavior following cognitive processes and environmental manipulations (Mulhollem, 2017). Therefore, the SCT builds on the fact that an enabling environment and personal factors can influence behavior leading to self-efficacy

(Forthofer et al., 2016). This theory further emphasizes learning from the social environment in which people may set personal goals, evaluate them over time, get motivated by the progress made, and achieve self-efficacy (Schunk & Usher, 2012).

Various researchers have used SCT to guide studies that explain or predict behavior change and health promotion initiatives. For instance, the study of community health worker support to improve HIV treatment outcomes for older C&As in Zimbabwe was grounded in the SCT with a focus on its concept of self-efficacy, which discussed an individual's ability to act on his or her intentions (Dziva Chikwari et al., 2018). The “shape” intervention which utilized the interactive obesity treatment approach (iOTA) in a study on the effect of a weight gain prevention intervention on moderate-vigorous physical activity among black women in the United States was grounded in the self-efficacy concept of the SCT (Greaney et al., 2017). Others, such as Duprez, Beeckman, & Hecke (2017), used the theory to explain the self-reported performance of supporting patients' self-management by final-year nursing students. They found out that the students performed poorly and recommended that more attention be given to it in training schools (Duprez et al., 2017). These examples highlight how the theory has been used to explain social and environmental issues and their influence on various outcomes.

Appropriateness of the SCT for This Study

The study had C&As as the study population. They constitute a population that is mostly dependent on their parents and caregivers for where they live, what they eat, the friends they interact with, and to a great extent, what they know, social protection, and the decisions they make (Bröder et al., 2017). They are also fast learners and quickly

learn and develop the confidence to perform specific tasks (self-efficacy) when given the enabling environment. As explained previously, the HIV clinics used various care models to provide services to C&As living with HIV, thus, exposing them to various environments. Although the use of CAFCs, for instance, enabled them to play with other C&As with the same health condition, the SCVs did not give them such opportunities. The specific person who provides care and support for these children at home might also influence their behavior and ability to learn and adapt to new regulations, such as remembering to take ARVs daily. The involvement of concepts like cognitive learning, social environment, interaction, self-efficacy, and adopting new behavior in the research made the SCT the most appropriate for use.

The support provided by parents /caregivers to the C&As at home, the therapeutic sessions, play sessions, and enhanced adherence counseling sessions received through CAFCs, their interaction with the care providers and their peers might have positively influenced their retention in care and viral suppression rates compared with those in standard clinics. The opportunities were likely to increase their understanding of the importance of staying in care (Bröder et al., 2017) and improve their self-confidence in addition to the determination to stay healthy (Forthofer et al., 2016). This assertion was in line with the first and second hypotheses, which were accepted or rejected following the study findings. The social environment at home varied per child and could be worst for children not living with their parents, leading to retention and viral suppression challenges. In line with the third hypothesis, it was likely that C&As living with their parents would have more favorable conditions that improve their social cognitive

behavior and ability to stay in HIV care/ achieve viral suppression compared with those living with foster parents. Therefore, the research questions were grounded in the SCT, which was used to explain the findings obtained.

Literature Review Related to Key Variables and Concepts

There is still no cure for HIV, and people living with the virus must be on treatment for life, respecting their treatment protocols to achieve viral suppression and remain healthy. Retention in HIV care, therefore, is critical for achieving viral suppression. It is unclear if the various care models used to provide HIV services to C&As in routine care settings are effective, given the continuous poor performance on retention in care and viral load results. Also, it is unclear if the outcomes of the C&As in care may be affected by the choice of the person who provides care and support for them at home. This chapter reviewed the literature to explore findings from other countries with similar challenges in their pediatric and adolescent HIV programs. My review was guided by the outcome and exposure variables included in the study and mostly limited to findings from Africa.

Overview of HIV and Its Interaction With ART

HIV is the virus that causes acquired immunodeficiency syndrome (AIDS). When someone becomes infected with HIV, the virus affects the body's defense mechanism. The virus gets into the defense cells (T-cells) and replicates rapidly, killing the cells, increasing its number, and rendering the person vulnerable to other infections (Cluver et al., 2016; Janssen et al., 2014; Kukoyi et al., 2016). ART has proven to be the effective treatment which if taken consistently as prescribed can reduce the virus in the body to an

undetectable level (León et al., 2011; Musinguzi et al., 2017; Silver, Dickinson, Seaman, & Desrosiers, 2019).

Previously, the CD4 Count was used for measuring the level of HIV in the blood of people living with HIV (PLHIV) to determine if they need to start taking ART (Kwarisiima et al., 2017). Various cut-off values were prescribed at different time points for PLHIV to start ART until 2015, when the World Health Organization (WHO) recommended the "Test and Treat" strategy following scientific evidence from various countries, especially Malawi (Dodd, Garnett, & Hallett, 2010; Lima et al., 2015; McCreesh et al., 2017; Wagner, Kahn, & Blower, 2011). In the context of "Test and Treat", the CD4 count is no longer used to determine if a PLHIV should start ART or not but is used for clinical monitoring. There is increased use of viral load measurements to assess ART's progress for PLHIV (Kukoyi et al., 2016; Mlisana et al., 2014; Sabin & Lundgren, 2013). The third 90 of the UNAIDS 90 90 90 targets states that at least 90% of those on ART should achieve viral suppression by 2020 (UNAIDS, 2014).

So far, there is no cure for HIV infection, but there is the treatment that effectively controls and keeps the virus at an undetectable level in the blood (Silver et al., 2019). There was high HIV attributable mortality and morbidity, especially in SSA some years back, due to a lack of effective treatment for those infected (Essajee et al., 2015; Granich et al., 2015). The rapid expansion of ART use within the past few years has transformed the lives of those living with the virus in the African sub-region. Some ten years ago, there was limited availability of ART in Cameroon, and in the few clinics where it was present, it was too expensive for most of the population to afford. An HIV

diagnosis was thus seen as a death sentence, and there was high morbidity and mortality due to HIV. Access to ART increased from 2007 when the Government of Cameroon approved the provision of ART free of charge to those in need according to the treatment protocols at that time. This increase became rapid from 2013 when the country adopted and started promoting the WHO Option B+ strategy to prevent mother to child transmission (Muffih et al., 2018). The scale-up became even greater from 2016 when the "Test and Treat strategy was adopted in the country.

Summary of studies related to retention in care

Several studies exist in the literature highlighting the importance of retention in care and various strategies used in different settings to achieve good retention. While retention in HIV care is a major issue in many countries highly affected by the HIV pandemic in SSA (Billong et al., 2016; Kiwanuka et al., 2018; Tomori et al., 2013), it was a necessary step towards achieving viral suppression (Hall et al., 2017). Retention in care helps to improve survival while reducing the chances of transmission of HIV to others (Nansseu & Bigna, 2017; Saito et al., 2019; Yehia et al., 2014). Therefore, a successful HIV program is that with good retention in care and viral suppression.

The World Health Organization (WHO) launched the "Test and Treat" strategy in 2015 to increase access to ART to reduce HIV related mortality following evidence from Malawi (Dutta, Barker, & Kallarakal, 2015; Haas et al., 2019; Harries et al., 2016). Starting ART early and "Test and Treat" can reduce HIV transmission rates in the population (Estill et al., 2018; Nansseu & Bigna, 2017). However, the "Test and Treat"

strategy demands improved retention in care as many more people are likely to start ART without appropriate preparation (Koirala, Deuba, Nampaisan, Marrone, & Ekström, 2017). Researchers like Yotebieng et al. (2019), in their consensus statement from the International epidemiology Databases to Evaluate AIDS (IeDEA) titled *Research priorities to inform “Treat All” policy implementation for people living with HIV in sub-Saharan Africa*, state that effective implementation of Test and Treat can end the AIDS epidemic. Many countries in SSA have witnessed a rapid increase in ART uptake within the last few years, and there is already documented evidence of high attrition within the first year of ART initiation (Agolory et al., 2017). Another team of researchers recently published their study findings showing that newly identified patients who initiated ART within the first 30 days following diagnosis were more likely to be retained in care than those who initiated ART after 30 days (Brown Id et al., 2019). The current wide coverage of the “Test and Treat” approach in many countries calls for innovative strategies to prepare patients adequately prior to treatment initiation and increase the chances for retention.

Documented evidence from the SSA region shows various factors associated with retention in care in various sub-populations. A systematic review conducted by Bulsara, Wainberg, Newton-john, Centre, & Hills, (2018) using thirty articles found out that physical health factors were associated with poor retention in care. In a qualitative study by Yehia et al., (2015), participants identified expensive and unreliable transportation, stigma, and insufficient insurance as key barriers to retention. Another team of researchers also identified transportation cost as a barrier to retention after conducting a

survey among 318 patients returning to care after being lost for at least 12 months, confirming the finding by Yehia (Gonzalez et al., 2016). Another qualitative study by Topp et al. (2018) identified social networks and health system factors as those that facilitate or undermine patients' ability to stay in care, which is in line with Bulsara's team's findings. Others, like Enane et al., (2018), on their part, identified that certain interventions work for adults in improving retention but may not work for children. This finding confirms the need for population-specific interventions recommended by Kiwanuka and colleagues after a similar study in Pregnant and Breastfeeding Women (Kiwanuka et al., 2018). To achieve universal targets for retention in HIV care, various program implementers need to use context-specific interventions that are most likely to fill the gaps in the given setting.

Achieving Retention in Care could be more challenging in C&As living with HIV than adults. This challenge is because they constitute a vulnerable population (Gray et al., 2016) as they depend on their parents or other caregivers for shelter, food, clothing, education, and other basic needs. A study conducted in South Africa demonstrated that family stability was a predictor of low adherence to ART in adolescents. They demonstrated that orphans were those most likely to have multiple caregivers, and having multiple caregivers was associated with poor adherence (Sher, Norton, Nickell, Biggs, & Roux, 2014). A team of researchers from Swaziland confirmed the need for a stable home for adolescents who want to belong to stable families, feel accepted, welcomed, and appreciated (Shabalala, De Lannoy, Moyer, & Reis, 2016). Unfortunately, many C&As on ART do not live in stable homes and are bound to face some of these challenges

reported in these studies. However, a study by Gopakumar et al., (2018) on the impact of foster homes on the Health-Related Quality of Life (HRQOL) for C&As living with HIV in the foster homes compare to stable homes found no statistically significant difference between the two. While this result provides hope for the children living with foster parents in other settings, the findings' generalization may be questionable, calling for further research in that domain.

Several studies conducted in Cameroon to measure retention in HIV care recorded retention rates of less than 90% at 12 months. In a study that collected data from 56 health facilities in all ten Cameroon regions, the 12 months retention rate was 60.4% and was calculated for 5,005 patients, including adult men, women, and children. The treatment centers in reference hospitals had lower retention rates compared to smaller HIV management units (54.2% vs. 66.8%), $p < .0001$; males had lower rates compared to females (57.1% vs. 62.0%), $p = .007$; and there was no significant difference in retention rates between adults and children (Billong et al., 2016a).

The 12 months retention in care was 79% in a prospective cohort of 669 PBFW enrolled on PMTCT Option B+ at 22 purposefully selected health facilities in two regions, the Northwest and Southwest (Muffih et al., 2018). A similar study focusing on PMTCT women completion of the HIV cascade found out that only 355 (36.4%) of the 976 HIV-infected women enrolled completed the PMTCT cascade (Dionne-odom et al., 2016). The findings also show two exposure variables associated with PMTCT cascade completion, which were; awareness of partner HIV status (aOR 1.4, 95% CI 1.01–2.0)

and receiving an HIV diagnosis before pregnancy compared with HIV diagnosis during or after pregnancy (aOR 14.1, 95% CI 5.2–38.6). This finding emphasizes the importance of partner/family support to those on ART, consistent with what was reported by Shabalala et al., 2016. Another PMTCT study of 12-month retention in care for 268 PBFW on Option B+ in five sites in the Kumba Health district found an 81.1% retention rate (Atanga et al., 2017). The researchers went further to document high staff turnover as the main reason for discontinuation [aOR 2.5 (95% CI 1.6, 3.9), $P < .001$]. The main reasons for stopping treatment included status denial, religious reasons, and lack of transport fare to go for medication pickup (Atanga et al., 2017).

The published literature on pediatric and adolescent HIV care in Cameroon has little on their retention in care or viral suppression. A study on malnutrition conducted at the Laquintinie Hospital in Douala identified an urgent need to detect and treat malnutrition in children below five years enrolled on ART. The prevalence of malnutrition in the sample of 217 children under 5 was 68.7%, with 42.4% of them in the severe or advanced immunological stages of HIV, according to WHO (Penda, Moukoko, Nolla, Evindi, & Ndombo, 2018). Children in the severe and advanced WHO stages are likely to develop treatment failure and eventually die (Tchouwa et al., 2018). However, another study conducted in Yaounde to measure predictors of mortality in children who had been on ART (2005 – 2009) found out that the probability of survival after four years of treatment was 88.7% (95% CI = [84.2–93.3]) with the WHO clinical stages III and IV (HR: 3.55 [1.09–13.6] and HR: 7.7 [3.07–31.2]) independently associated with death (Njom Nlend & Loussikila, 2017). A similar study by Prof. Nlend to measure the

outcomes of protease inhibitor-based ART in children and associated-factors found out that all the 71 children (5-12 years) enrolled and who had been on ART for a mean duration of 7 years experienced clinical success in their therapeutic responses with a 74.7% viral suppression rate (Nlend et al., 2019). Programmatic data from national reports show lower viral suppression rates in C&As. The study generated findings from various sites implementing routine care practices that will contribute to the existing literature in this domain.

Summary of studies related to viral suppression

HIV Care providers previously used the CD4 count to determine when it was appropriate for someone diagnosed with HIV to start ART and used it to monitor their progress on ART. Since 2013, WHO recommended using viral load to monitor patients on ART, but the coverage remained limited in Low and Middle-Income Countries like Cameroon (Peter et al., 2017). Viral Load values indicate whether the person on ART is thriving well or if there is treatment failure that needs a revision of the treatment plan. With limited coverage of viral load, as is the case in many countries, it becomes challenging to assess progress on the third 90, viral suppression (Peter et al., 2017). Therefore, there is an urgent need to scale up viral load coverage in HIV endemic countries and improve on the use of the results in patient management to improve outcomes.

Several studies have documented inadequate viral load coverage in developing countries, especially those in SSA. The WHO and other international recommendations for using viral load to monitor ART patients have not been directly translated into local

policies and actions (Killingo, Taro, & Mosime, 2017). Even with policies in place, there is a need for a supportive environment for their implementation and demand creation through mobilization, training HCWs on sample collection, transportation, and return of results. As documented by Killingo et al., (2017), there is a need for the use of demand creation models to achieve the 90 90 90 goals by 2020, and routine viral load monitoring becomes more relevant now than ever before. The possibility of using point of care machines for viral load testing further increases access to testing services (Kulkarni et al., 2017). Program implementers could draw experiences from the scaling up of EID services for HEIs and CD4 count measurement using POC machines, which are two interventions rapidly scaled-up in previous years to scale up viral load coverage (Peter et al., 2017).

Viral load coverage is even lower in C&As who need closer monitoring and adjustment of doses or regimen switching based on their outcomes (Ferrand et al., 2017). An international cohort collaboration recently published an article in the *Lancet* that documents high rates of missed opportunities in switching children to second-line ART due to poor monitoring strategies (Collins et al., 2019). Their study had a large sample size (93,351 participants) and included data from several countries, with 90% of SSA participants. They found out that health care providers use various strategies for monitoring children on ART, including the use of CD4 counts, viral load, and clinical monitoring. The cumulative incidence of switching to a better therapy when indicated varied from 6.8% (6.5-7.2) in settings where CD4 or viral load were used to 0.8% (0.6 - 1.0) in settings where only clinical monitoring was used (Collins et al., 2019). This

finding highlights the alarming number of missed opportunities occurring in settings where children on ART go for years without any CD4 or VL test done. A study from Cameroon has documented improved viral suppression rates for children enrolled on Protease inhibitor-based ART (Nlend et al., 2019), which could become an option to switch to if the outcomes for other regimens are not as expected. Another study carried out in the Eastern Cape region of South Africa highlighted the need for greater monitoring of children to avoid viral rebound even after viral suppression has been achieved. The researchers followed-up children from 0-12 years for 24 months through quarterly visits and noticed increasing viral suppression rates over time [at six, twelve, and twenty-four months were 57.6% (95% CI 52.1 to 62.7), 78.7% (95% CI 73.7 to 82.9) and 84.0% (95% CI 78.9 to 87.9) respectively]. However, they also found out that younger children <12 months had a twofold increased risk of viral rebound compared with six to twelve-year-old (Teasdale et al., 2018). A similar study from Ghana highlighted the urgent need for increased viral load monitoring (Kukoyi et al., 2016). Programmatic data from Cameroon confirm this need, especially in rural areas.

C&As also have an increased risk of having poor treatment outcomes associated with where they receive care. A cross-sectional study conducted in Cambodia in adolescents 15-17 years old found the likelihood of having viral non-suppression was higher in adolescents receiving ART in an adult clinic (Chhim et al., 2018). The researchers recommended implementing interventions that promote psychosocial support and treatment literacy, which have been implemented in Cameroon. Another study focusing on the decentralization of pediatric care services identified the transfer from one

facility to another or the community as a particularly vulnerable step in the pediatric and adolescent treatment cascade (Teasdale et al., 2017). Teasdale and her colleagues (2017) reviewed medical records in a high-volume clinic (Dora Nginza Hospital in Port Elizabeth, South Africa) for all children 0-15 initiated on ART between January 2004 to September 2015 and identified all those transferred out following the decentralization of ART. They followed up in 16 outlying clinics where the children were transferred and carried out community tracing for children who were not in care in the facility they were transferred. They found out that of the 644 children transferred to the 16 sites, 211 (32.8%) had an unsuccessful transfer (Teasdale et al., 2017). An unsuccessful transfer indicates that the child stopped treatment with increased chances of viral load rebound and the likelihood of mortality. Not many programs have gone out of the regular clinic visits to follow up those not regular in care, as was done in this study. The need to improve the follow-up for children and improve reporting on their virologic outcomes is critical (Ferrand et al., 2016), given the overall low performance on the outcomes (retention & viral suppression).

Pediatric ART services in Cameroon were previously limited to few big hospitals in the big cities and other clinics that identified an HIV positive child referred to these large clinics for evaluation and possible ART initiation (Njom Nlend & Loussikila, 2017). Given the transportation challenges and related costs involved in covering long distances to the cities for regular care, it was apparent that the retention in care and viral suppression rates for such children linked from long distances will be low. The study by Billong et al. (2016b) found out that children had lower retention rates than adults, and

the other study by Tchouwa et al. (2018) recorded lower viral suppression rates for children in big reference hospitals in Cameroon. While the big hospitals have higher quality medical teams and equipment needed to monitor the C&As, personal factors, distance, and cost limit the hospitals' visits, leading to these poor results.

The use of viral load results for patient management

With sub-optimal coverage of viral load testing in C&As in Cameroon, there is also limited capacity among care providers on its used for patient management. Patients with high viral load require close follow-up and possibly a change of regimen for improved outcomes. A cross-sectional study carried out in 12 health facilities across seven of Cameroon's ten regions documented the low capacity of health care workers in initiating and managing children on ART and their limited knowledge on the content of national standard protocols (Penda et al., 2019). Another Cameroonian study also documented low viral load uptake in adults, with only 54% of those with high viral load switched to a second-line regimen (Awungafac et al., 2018). Therefore, while efforts are made to increase the uptake of viral load, using viral load results in managing the patients for improved outcomes is even more critical.

Models of Care implemented to improve retention in care and viral suppression

Existing literature has several best practices used in studies in various SSA countries to improve treatment outcomes for C&As. While some of the researchers evaluated outcomes in terms of retention in care, others measured viral suppression rates or both. The findings generally highlighted the importance of using differentiated care

models to tailor the services provided to the needs of the patients. They used Randomized Control Trials (RCTs), mixed methods, surveys, and qualitative approaches to study and document their findings. RCTs included the study that highlights the impact of a family clinic day in Uganda (Graves et al., 2018), the importance of the streamlined care model in East Africa (Brown et al., 2016), the use of community-based interventions in Zimbabwe (Mavhu et al., 2017) and a community demand creation model (Killingo et al., 2017). Other researchers used the prospective cohort monitoring approach, including the study in Uganda and Kenya that highlights the importance of streamlined care models to reduce structural barriers (Kwarisiima, Jain, Ruel, & Clark, 2017) and from South Africa on the importance of adherence clubs (Tsondai et al., 2017). Another team of researchers used the mixed methods approach to study the effect of patient-centered approaches such as multi-month dispensation, fast-track drug refills, community ART groups, and other strategies to improve individual patient outcomes (Prust et al., 2017). Lettow et al. (2014), on their part, used a Survey approach to highlight the importance of differentiated models of care in PMTCT clients, while MacCarthy, Mendoza-Graf, Huang, Mukasa, & Linnemayr (2019) used a qualitative approach to point to the importance of patients setting personal targets for their treatment outcomes. These encouraging results from research studies provide hope for the achievement of the third 90, although the generalizability of some of the findings is questionable.

Research findings with specific samples of the population may hardly reflect the situation in routine health care settings. A recent study by Mathew Fox and others showcased the importance of adherence clubs and decentralized care in improving viral

suppression rates and sustaining the suppressed status over a one-year follow-up period in South Africa (Fox et al., 2019). Another study documented the improved viral suppression rates following an intense adherence counseling program for C&As in Uganda (Nasuuna et al., 2018). On the other hand, an evaluation of the national HIV program in Nigeria showed low retention and viral suppression despite the many interventions by the government and various inputs from international partners (Dalhatu et al., 2016). Similarly, the findings from the Cameroon population-based HIV impact survey of 2017 showed an 80.1% viral suppression rate with low viral load coverage (CAMPHIA, 2018). While some of these impressive interventions that have generated significant results in the different studies may not yield the desired results in routine settings, the resources required to implement them may also be a limitation to a national scale-up plan. Besides, the estimated resource requirements for ART programs working towards the 90 90 90 targets and implementing the test and treat strategy are enormous (Dutta et al., 2015). There is a need to identify cost-effective strategies that could be scaled up with minimum resources (Barker, Dutta, & Klein, 2017). The study has generated evidence for the most effective current use approaches, which could be implemented at scale in Cameroon.

The role of family status or the caregiver on treatment outcomes

Apart from the clinical care and medications provided through the clinics, C&As need enormous support from the family to stay on ART and achieve viral suppression. This care is provided by their parents or other family members. Few researchers have studied the contribution that the child's family status or type of caregiver at home may

play on C&As' treatment outcomes on ART. Two studies from Uganda, South Africa, and Malawi document HIV's burden on child development and health outcomes. Sherr, Skeen, Hensels, Tomlinson, and Macedo (2016) found out that HIV positive parents suffered from depression, which affected their children's development. Caring for an HIV positive child could also lead to depression, which will affect even the child's care.

Another group of researchers found evidence that home-based care for children living with HIV was burdensome and should not be left in the hands of caregivers alone (Osafu, Knizek, Mugisha, & Kinyanda, 2017). Gray et al. (2016) presented evidence that orphans were more likely to have traumatic experiences that lead them to risky reproductive health practices, which could be worst for those on ART. Another team in South Africa documented multiple caregivers' effect on retention and viral suppression but identified that orphanhood was not associated with viral suppression (Sher et al., 2014).

Orphanhood was not associated with death in children on ART according to findings from a Cameroonian study (Nlend et al., 2019). A similar study from India found no association between living in foster homes and quality of life plus the risk of HIV infections (Gopakumar et al., 2018). With this limited and contradictory existing evidence on the association of family/caregiver to treatment outcomes in C&As on ART, further research is needed to provide more guidance on the topic. These findings justified the inclusion of the third research question in this study.

Summary of studies that used a retrospective cohort monitoring approach

With limited resources and time available for research on retention in care and viral load status requiring long-term follow-up, it is easier to use retrospective studies to

examine from the outcomes backward and study the exposures that may explain the variability in the outcome. The study that evaluated the national HIV program in Nigeria used the retrospective approach (Dalhatu et al., 2016). These authors analyzed cohort data extracted from medical records for a nationally representative sample of 3,496 patients >15 years old recruited on ART from 2004 – 2012. Three other related studies that used the same methodology include; A study conducted in Swaziland which documented 12.5% retention at 12 months of 32 children <18 months recruited and followed up through routine child welfare clinics (Sikhondze & Mahomed, 2017); a study of retention in injection drug users on ART in Vietnam who were also taking methadone therapy (Pham et al., 2017), and the study conducted to identify early warning indicators of HIV drug resistance in Cameroon in 2010 (Billong et al., 2012).

The advantage of using the retrospective cohort monitoring approach in these studies is seen in the time taken to conduct them and the resources required. The researchers were able to generate evidence from the interventions without waiting for long-term follow-up to establish outcomes. They were also easy to conduct and did not have the objective of establishing a causal relationship. Researchers seeking to prove a causal relationship cannot use a retrospective cohort approach but will instead carry out randomized control trials or prospective cohort monitoring approaches or other complicated study designs. I had limited time to complete my research and complete my dissertation. My objective was to establish if there is an association between care models and type of home-based caregivers on the retention in care and viral suppression status of C&As on ART. It was a simple study to be completed quickly, and the retrospective

cohort approach was sufficient for answering the research questions. The variables and covariates included were those available in the existing medical records and enough to respond to the research questions.

Summary of the chapter

Summarily, much evidence exists on the importance of retention in HIV care, retention challenges, interventions that have proven effective in particular settings, differentiated models of care, the urgent need for scaling up viral load coverage, use of viral load results, and limited studies on the relationship between the type of home-based care provider and treatment outcomes for C&As. There are few studies focused on treatment interventions to improve outcomes in children compared to the several adult-targeted interventions. Few studies included viral load/viral suppression in C&As in Cameroon as an indicator, and none that focused on it specifically. The study conducted in the National Social Insurance Fund hospital looked at orphanhood as a predictor of death which could relate to viral non-suppression (Njom Nlend & Loussikila, 2017), but did not look at the person who provides support to the orphan or non-orphan and to see if it is also associated to mortality. Therefore, this study is the first to document retention and viral suppression by care models used for C&As in Cameroon and is the first to document if there is an association between the type of caregiver at home and the outcomes. Findings from the study will also create the basis for further studies. For instance, a tracing campaign to search for and bring back children lost to follow-up and interview their caregivers to document reasons for drop out could be a likely next step after this study. Other researchers may also be interested in conducting the same study

prospectively while monitoring the clinical and psychosocial services provided to see if they may obtain similar results.

Conclusion

I reviewed and summarized the literature on retention and viral suppression for C&As living with HIV and their association to models of care used and family status or type of caregiver who supports them at home. The lack of any publication comparing treatment outcomes in various models of care used in routine care settings and lack of any study that looked at the association between the outcomes and the person who provides care to the C&As at home indicated the pressing need for my study. I used a retrospective cohort monitoring approach to review, analyze and share findings from Cameroon on the topic. The description of the methods used to conduct the research is found in chapter 3.

Chapter 3: Research Method

Introduction

The purpose of this study was to compare the 12 months' retention in care and viral suppression rates for C&As enrolled on ART in Cameroon by the care models used to manage them to identify the model with the best outcomes for possible scale-up. The study also assessed if there are significant associations between the type of the home-based care provider and viral suppression and the type of home-based care provider and consistency of medication pickup in C&As on ART in Cameroon. The study's primary outcomes were retention in care at 12 months, viral load status, which is often classified as suppressed or not suppressed based on the value, and the proportion of consistency in medication pickup. The exposure variables were the care models used and the type of the home-based caregiver. Possible confounders included in the study were age and sex. In this study, I sought to identify the best HIV care model among the three used and the type of home-based caregiver associated with better outcomes in routine health care settings in Cameroon for C&As, which could fill an existing gap in the literature. The findings could also inform program planning, funding prioritization, family counseling practices, and national program scale-up strategies that promote specific high-impact interventions.

In Chapter 3, I will describe the research design, methodology, study population, participant selection, and operationalization of variables, data collection, cleaning, analysis, and interpretation of results, threats to the validity of results, ethical considerations, and IRB requirements. I conclude the chapter by connecting to this plan's operationalization, whose findings I describe in Chapter 4.

Research Design and Rationale

I used a quantitative method of inquiry with a retrospective cohort review approach to collect and analyze existing data from medical records in the ART clinics on C&As (0-19 years old) who were current on ART in Cameroon from January 2018 to December 2019. Retention in care and viral suppression are achieved over time. Therefore, studying them using a retrospective cohort review approach saved time. Because monitoring interventions prospectively takes a long time, more resources, and a lot of effort, it was easier to collect information from existing medical records for this research, cognizance of the approach's limitations. Further, I looked for associations between the outcomes and exposure variables and not for some causal relationships. A retrospective cohort approach was appropriate for a quick study like this one whose findings were needed soon and could prompt intervention studies that monitor a particular aspect of care over time.

The study variables included the viral load status and retention rate at 12 months as the primary outcome variables. The exposure variables include the models of care, the family status or type of home-based caregiver, and two covariates: age and sex. The outcome variables had quantitative measures classified into categories to ease analysis, justifying the use of a quantitative research methodology. Viral load testing, according to the national protocol, is done 6 months after ART initiation. In this study, I planned to assess the 12 months' retention in care for the study participants, the consistency of their medication pickup, and the viral load results. An intervention study with randomization and prospective participant recruitment and monitoring over time would have been the

best method of inquiry to establish causal effects. I decided to use a retrospective cohort study approach in this case given the amount of time and resources required for intervention studies, the convenience of using existing data, and my objective of looking for associations and not causal relationships. However, my design was robust, and the large sample size recruited from five of the 10 regions of the country, which represented about 70% of the HIV burden, strengthened the generalizability of the findings.

Target Population

The study population included all C&As aged 0 to 19 years old, living in Cameroon. These included males and females, those schooling and those not schooling, those living with their biological parents, and those living with foster parents. Cameroon currently has a total population of approximately 24 million people, with approximately 5% being C&As ages 0 to 19 years. The C&As included those living with HIV, which they might have acquired from their mothers while still in the womb, delivery, or other sources after birth. National estimates indicated that approximately 4,100 children acquired HIV in 2015, and only approximately 30% of those living with HIV and on ART had a viral load test done (Rao et al., 2019). This study focused on the C&As living with HIV and enrolled on ART in 27 clinics in five of the 10 regions. Being a retrospective cohort study, the review of records and data collection focused only on the period from January 2018 to December 2019.

Sampling and Sampling Procedures

The selection of regions and clinics for the study followed a convenient sampling procedure. I used purposeful sampling to select the regions because the various HIV care

models were implemented only in some sites in these regions. The Northwest, West, Center, Littoral, and Southwest regional programs used child and adolescent friendly clinics in some clinics and support groups in others. The West regional program used only support groups and standard clinic visits in all their clinics. These regions were also more accessible in terms of the distance to cover to sites and obtaining administrative approval to collect data was more straightforward than the other five regions. Site selection from the five regions was purposeful to ensure that the sample chosen included a reasonable number of children in each care model. I sought a representative population living in urban versus rural areas and these five regions have over half of the total number of people living with HIV in the country. Achieving a good rural/urban mix of participants required many more sites in rural areas because most big pediatric ART sites were in the cities where just one clinic could have the necessary number of participants for a model. Therefore, more sites were purposefully added from the rural areas. In the various selected clinics, C&As were included if they met the participant inclusion criteria.

Participant Inclusion and Exclusion Criteria

The study sample included only C&As 0 to 19 years old, males and females living with HIV, and who were on ART for 12 months (between January 2018 and December 2019) in the selected sites. This sample included those who were already on ART before starting the period and those who initiated ART during the period and attained 12 months on treatment before December 2019. I excluded those who started ART within this period but were not on it for up to 12 months because retention in care was assessed for 12

months. Also, participants included were only those who had at least one viral load test done and documented within the 12 months. I did not include those on ART within this period but did not do a viral load test because the viral load status was the primary study outcome. This exclusion criterion justified why many sites were included to meet the desired sample size for care models.

Sample Size Calculation

This study's objective was to examine the associations between two independent variables that were categorical and two dependent variables, one of which was continuous. The independent variables were models of care divided into three categories, and the type of home-based caregiver was also divided into three groups. The models of care were child and adolescent-friendly clinics, support groups, and standard clinic visits. The type of home-based caregivers included both parents, one parent (mother or father), and foster parents (aunt, uncle, sister, brother, others). For the dependent variables, viral load status was measured in the number of copies per milliliter of blood and classified into two categories based on the values. I coded this variable into a dichotomous variable with values less than 1000 as "suppressed" and values more than 1000 as "unsuppressed." Retention in care is another dependent variable that was assessed and was measured by the proportion of C&As on ART or enrolled within the study period who remain in care after 12 months. The consistency of medication pickup was also assessed for each client within the last 12 months. The proportion of months on ART (as documented in the registers) was calculated and recorded for each client. For this study, I included age and sex as covariates. Sex was a dichotomous categorical variable, and

participants were either males or females. The C&As were managed in four groups at the clinics for age-adapted therapeutic education. These groups included children ages 0 to 4 years, those 5 to 9 years, 10 to 14 years, and adolescents 15 to 19 years. This study classified them into two groups with those aged 0 to 14 years seen as children and those aged 15 to 19 years as adolescents. I used the logistic regression as the statistical analysis method to determine the predictive association between the dependent and independent variables. I ran a binary and multiple logistic regression analysis to test the study hypothesis. I also used ANOVA to check for an association between the consistency in medication pickup and type of caregiver. I interpreted the findings using an alpha equal to or less than .05 as significant.

Using G*Power, version 3.1.9.2 (Faul, Erdfelder, Lang, & Buchner, 2007), I estimated the study's sample size while making certain assumptions (American Statistical Association, 2017). I assumed an alpha of .05, a 95% power, a two-tailed test, and an effect size (Odds ratio) of 1.3, which gave me a minimum sample size of 1,188. Reducing the study's power to 80%, which is the minimum power required to have reliable results (Meyvis & Osselaer, 2018), gave me a minimum sample size of 721. I planned to use the sample size that provides the maximum power to the study results, which was the 1,188 participants. The effect size of 1.3 was the minimum required to determine a predictive relationship between the dependent and independent variables. Being a retrospective cohort study, I included all eligible participants in the selected study sites as it was feasible to have the largest sample size. Having a large sample size would generate more representative results of the population's real situation (Meyvis & Osselaer, 2018). Given

the low uptake of viral load testing in C&As in Cameroon (CAMPHIA, 2018), I had to visit many more sites to obtain at least a minimum of 1,188 participants to maintain the power of 95% and an effect size of 1.3.

Procedures for Participant Recruitment and Data Collection in the HIV program

The national protocol in Cameroon requires that once somebody tests HIV positive, they should receive counseling and encouragement to start ART on the day of diagnosis or within one month. A positive HIV test result is, therefore, the main inclusion criteria for ART initiation. People who test HIV positive and are not willing to start treatment immediately, are too sick to take medications or are on treatment for Tuberculosis are excluded until they become ready to start ART according to the national protocol. Once initiated on ART, demographic information on several indicators like age, sex, location, parent's HIV status is collected and documented in the national registers. Baseline information, including results of various tests conducted and treatment regimen, are also recorded in the registers. A medical file is opened for each patient, containing the demographic information and additional personal and clinical information about the patient. Patients give their consent to start ART. Those who refuse to begin ART receive ongoing counseling support and eventually decide to start, but nobody is forced to start ART. After ART initiation, service providers document necessary information for each clinical visit in the two records (registers and files), facilitating patient follow-up. These patients are expected to stay on ART for life, except researchers eventually find a cure for HIV. However, some participants drop off with time due to various reasons that lead to poor retention in care for specifically C&As. Service providers used various strategies to

achieve full retention in care, including differentiated care models tailored to the needs of the individual patients and monthly patient tracking and bring back-to-care campaigns. The data in the medical records has evidence for retention since each visit is documented. The various clinical monitoring exams done, such as the viral load test, are also noted in these tools.

Participant selection and data collection

I used participant data already existing in registers and medical files in the hospitals for the study. As described under the target population, I selected 27 study sites in the five regions based on the model of care implemented. At the sites, participant selection was limited to those current on ART during the study period who had been on ART for at least 12 months and had at least one viral load test result documented in the records. These registers and medical files are the most reliable source documents for routine HIV services in all sites. Therefore, their use is inevitable in the conduct of retrospective studies like this one.

In each site, I used the registers to identify the appropriate cohort of patients selected for the study. With the help of the site leader or the nurse in charge of the pediatric cohort, we retrieved their medical files. The use of the registers and medical files concurrently was inevitable since information completion in the tools was usually a challenge and using the two provided complete information. I then reviewed information on their viral load results from the registers and files and identified all those with a documented viral load result in the last 12 months. These were the participants whose information was collected, ensuring not to record identifiers like names or phone

numbers. The collected data were recorded on a data abstraction form, which was the only document I took away from the clinic. I excluded eligible patients with no complete information from the study after reviewing both the registers and medical files.

Before data collection, I obtained IRB approval from the National Ethics Committee, the Cameroon Baptist Convention Health Board IRB, and from the Walden University to conduct the study. I met with key stakeholders and leaders of all the 27 facilities involved in the study who provided administrative letters of approval for me to collect the data from their facilities. With all the approvals, I did not have any challenges in gaining access to data collection records.

Instrumentation and operationalization of constructs

I developed and used a data abstraction form, which I printed out in hard copy and used to record information on the variables of interest upon reviewing registers and medical records onsite. Since this was a retrospective study using secondary data, I ensured that all the variables I needed to analyze to answer the four research questions were included. To ascertain this, I did a pilot collection in one site, reviewed and analyzed the data to be sure that it had all my required variables, and made adjustments if any was lacking before conducting full data collection. I decided to use a hard copy data collection form because it was more feasible in sites without electrical power to charge computers. Besides, putting the information on hard copies to later enter the spreadsheet on the computer enabled sorting and correction of any errors, increasing the data's accuracy. The hard and soft copies carried participant codes with no identifiable

information. I entered the data into the soft copy of the excel form in the computer and later transferred it into SPSS version 25 for analysis. I explored and analyzed the data as I collected from one site to another, which was the advantage of collecting it personally. I, however, used two trained research assistances to collect data from a few far-off sites. The research questions were set based on the data available in the medical records. Other information that could be useful, but which did not exist in the medical records, was excluded from the study design. The data abstraction form, therefore, contained all information needed to answer the research questions.

Operationalization of variables

Viral Load status – primary outcome variable. The viral load status is used to assess ART treatment success in Cameroon, just like in other countries fighting the HIV epidemic. Blood samples are tested in the laboratory, and viral load results are obtained and presented in terms of the number of copies per milliliter of blood used. The number of copies recorded for each patient are usually classified into two main categories; virally suppressed for patients with viral load results less than 1000 copies/ml and virally unsuppressed for patients results indicating > 1000 copies/ml (Awungafac et al., 2018). The global UNAIDS goal for HIV programs was for every country to achieve 90% viral suppression in all those on ART by 2020 (Jamieson & Kellerman, 2016). The analysis of the patients' viral load status included in the study generated findings on their suppression rates, which showed at what percentage Cameroon is with the third UNAIDS goal in the study population and which model of care provided the lowest VL copies/ml.

Retention in Care. In HIV programs, retention in care refers to the number of patients still in care after a specified period (three months, six months, 12 months, or 36 months) following their ART initiation. In assessing retention rates, cohorts of patients who started ART within a given period are tracked to see how many of them remain in care over time. The number of those still in care compared to the number that started provides the retention with rates per site. In this study, retention was a categorical variable recorded as "retained" for those who were still in care after 12 months or "not retained" for those who dropped off either through death, transfer to other sites, or were lost-to-follow-up. Retention in care is almost an indispensable pre-requisite to viral suppression since patients need to stay in care and adhere to therapy to achieve viral suppression (Tsondai et al., 2017). For this study's purpose, I assessed retention in care for all study participants by checking their treatment status after 12 months or 12 months following initiation for those who started ART after Dec 2017 to note those still in care. This enabled me to record the proportion retained and calculate the retention rate by care model and region.

Consistency of medication pickup. For each participant, I calculated the proportion of months they were regular on ART during the 12 months as documented in the registers. The C&As who were on ART for all 12 months scored a 100% while those who missed medications for two months for instance had a proportion of 83% calculated by dividing the number of months on medication (10 months) by 12 months and multiplying by 100. During data collection, we counted and recorded the number of months on ART with the 12 months' period following the documentation in registers.

The calculation of the proportions was done after data entry and analyzing this data by type of care provider enabled me to answer the fourth research question.

Care Models. This study included three specific care models used to manage C&As in Cameroon. Some C&A attended just the Standard Clinic Visits (SCVs) and picked up their medications in addition to consulting a clinician if needed. Some clinics had organized group meetings and gave appointment dates to the C&As to visit the clinics on a specific convenient day, such as Wednesday afternoons or Saturdays when those schooling had no classes. These group sessions, also called Support Groups (SGs), provided an opportunity and time for the children to play together, sing, dance, receive health information, and pick their medications. These sessions held in a venue most appropriate to the health care providers based on the infrastructure available onsite. In the third option, health facilities, with external partners' financial support, renovated and equipped specific spaces within the facilities to serve as Children and Adolescent Friendly Corners (CAFCs), where the children met in age-adapted groups. Apart from playing and interacting with their peers, the service providers used a well-structured curriculum to give the C&A information adapted to their age on health, personal hygiene, HIV/AIDS, disclosure of HIV status, and reproductive health. In these groups, service providers ensured that C&As received both clinical and psychosocial care services during group activities. In sites where the SGs and CAFCs existed, C&A newly enrolled on ART were encouraged to join the group sessions. The participant enrolled in each model was based on the model's availability in the site where they received care. Participants in sites without CAFCs or SGs had no option but to belong in the SCVs care model. For

this study, I classified the participants into three groups based on their care model and coded the data for analysis.

The type of home-based caregiver. There was information available onsite on the caregiver for each of the C&As enrolled on ART and their HIV status. For this study's purpose, I named this variable as the type of home-based caregiver, which refers to the person available at home to support the C&A in their treatment process. I classified the information into three main categories; both biological parents, a single parent (mother or father), and foster parents who could be aunt, uncle, sister, brother, or others. I extracted information on each patient's caregiver and classified each of them in one of the three groups coded as P1, P2, and P3 for data analysis.

Age. Age is also written as an indicator on its own in the medical records but is hardly updated. I calculated each patient's age based on their date of birth, which was included in the medical records because the age in the records could be the age at the time it was documented and not the current age. I rounded up months greater than or less than six to the nearest whole number during age calculation. For example, I considered a child who was five years, eight months as a 6-years-old child, while taking one who was three years, four months as a three-year-old child. For this study, I classified the age values into two dichotomous categories: ages 0 -14 years as children and those 15-19 years as adolescents.

Sex. I classified each participant in the study into two dichotomous categories as male or female in line with the normal population distribution in Cameroon. This

information was copied from the medical records, documented onto the data abstraction form, and coded for analysis.

Data entry, coding, cleaning, and data analysis plan

Data entry, cleaning, and coding. As soon as I completed data collection for each site, I entered the data into an excel spreadsheet, a replica of the data abstraction form. I reviewed the data for consistency and corrected any entry errors that I identified. I crosschecked the entries again a few days after entry, matching the data abstraction forms to that in the computer to ensure data completeness and accuracy. Once I finished with all the data collection and entry, I use bar charts and histograms in excel to see the distribution of data for various variables pictorially and identify possible outliers. I created a codebook for the categorical variables in excel, which was required to interpret findings. I then exported the data into SPSS (v. 25) for analysis and reported both descriptive and inferential statistics plus their interpretations. Once the data was in SPSS, I recoded the continuous variables as appropriate for data analysis. I carried out data exploration by running means, medians, and standard deviations to identify and verify any outliers in the data for the continuous variables. I used frequency tables to examine the distribution of categorical variables and did any further data cleaning that could be required before the actual analysis.

A restatement of the research questions and hypothesis

Research question 1(RQ1). Is there an association between the 12 months' retention in HIV care and the HIV care model used for C&As after controlling for age and sex?

Null Hypothesis (H_01): There is no significant association between the 12 months' retention in HIV care and the HIV care model used for C&As on ART after controlling for age and sex.

Research Hypothesis (H_a1): There is a significant association between the 12 months' retention in HIV care and the HIV care model used for C&As on ART after controlling for age and sex.

Research question 2 (RQ2). Is there an association between viral suppression and the HIV Care model used for C&As after controlling for age and sex?

Null Hypothesis (H_02): There is no significant association between viral suppression and the HIV care model used for C&As after controlling for age and sex.

Research Hypothesis (H_a2): There is a significant association between viral suppression and the HIV care model used for C&As on ART after controlling for age and sex.

Research Question 3 (RQ3). Is viral suppression associated with the type of the home-based caregiver (the person who supports the child or adolescent at home) among C&As on ART in Cameroon?

Null Hypothesis (H_03): Viral suppression is not significantly associated with the type of home-based caregiver (the person who supports the child or adolescent at home) among C&As on ART in Cameroon?

Research Hypothesis (H_a3): Viral suppression is significantly associated with the type of home-based caregiver (the person who supports the child or adolescent at home) among C&As on ART in Cameroon?

Research Question 4 (RQ4). Is there a significant difference in the average proportions of the consistency in medication pickup for the different types of home-based caregivers (the person who supports the child or adolescent at home) among C&As on ART in Cameroon?

Null Hypothesis (*H₀₄*): There is no significant difference in the average proportions of the consistency in medication pickup for the different types of home-based caregivers among C&As on ART in Cameroon.

Research Hypothesis (*H_{a4}*): There is no significant difference in the average proportions of the consistency in medication pickup for the different types of home-based caregivers among C&As on ART in Cameroon

In a quantitative study, it is appropriate to begin data analysis with a description of the various variables. I carried out that analysis and presented descriptive statistics for each of the variables included in the study. For continuous variables like age, consistency in medication pickup and viral load status, I presented results using descriptive statistics like mean, median, mode, standard deviations, maximum and minimum values, confidence intervals, and appropriate histograms and box plots to present findings for easy understanding. For the categorical variables, care model, type of home-based caregiver, sex, 12 months retention, I generated frequency distribution tables that displayed the results in graphical format for easy reading. Also, I used a bar chart and a pie chart to show the distribution of per region and zone.

To respond to question one (RQ1), I ran a Chi-Square Test, binary, and multiple logistic regression models. I reported the Odds Ratio, the Chi-Square, which assesses the

Hosmer-Lemeshow Goodness of Fit Test of the model, and Wald test to assess individual variables. To respond to questions two and three, where the outcome variables were binary, I ran both binary and multiple logistic regression models using the sequential addition of variables into the model and interpreted their block statistics. I then reported the Odds Ratios, and my interpretation depended on the p -values, confidence intervals, the value of the Chi-Square test of its fitness, and tests of model coefficients. To respond to the fourth research question (RQ4), I used the one-way Analysis of Variance (ANOVA) test and used the F statistic and the Lavene's statistics with their associated p -values to interpret if there was a significant difference between the mean consistency of medication pickup for different types of home-based caregivers.

Table 1

The Dependent and Independent Variables Used in This Study

Dependent variable	Independent variables	Covariates
12-month retention rate	Care model	Age
Viral load status	Home-based caregiver	Sex
Consistency in medication pickup		

Table 2

Research Variables, Measures, and Coding

SN	Variable	Variable type	Level of measurement	Variable classification	Variable coding
1	12 months retention rate	Categorical	Nominal	Two categories. Retained and not retained	Retained = 0 Note retained = 1
2	Viral load status	Categorical	Nominal	Two categories. <1000 copies/ml = virally suppressed >1000 Copies/ml = virally not suppressed	Virally suppressed = 0 Virally not suppressed = 1
3	Age	Categorical	Nominal	Two categories: <15-year-old = children 15- to 19-year-old = adolescents	Children = 0 Adolescents = 1
4	Care model	Categorical	Nominal	Three categories: support groups (SGs), standard clinic visit (SCV), and children and adolescent friendly clinics (CAFCs)	Support groups = 0 Standard clinic Visits = 1 Children and adolescent friendly clinics = 2
5	Home-based caregiver	Categorical	Nominal	Three categories: both biological parents, father alone or mother alone, other foster parents (aunt, uncle, sister, brother, others)	Both biological parents = 0 Father alone or mother alone = 1 Foster parents = 2
6	Sex	Categorical	Nominal	Two categories: male & female	Male = 1 Female = 2
7	Consistency in medication pickup	Continuous	Scale	Recorded proportions	None

Threats to Validity

The representativeness of a study sample contributes to its external validity and generalizability of findings. This study included data from five of Cameroon's ten regions, which had a higher proportion of the total number of people living with HIV. It also included participants from rural, urban settings, public and faith-based institutions, French and English-speaking regions. It also had participants from Christian and Muslim communities, indicating a good mix of participants and cultures representing the Cameroonian population. The mixture in the sub-populations included as participants in the study, to a great extent, reflects the people in the SSA subregion. This mix increased the external validity of the study findings.

One of the assumptions critical for logistic regression is that the model must be correctly specified, including all the possible predictors, and should not include irrelevant predictors (Warner, 2013). This condition was not fully satisfied in this study because the predictor variables included were based on the research questions and data available and may not have been exhaustive, limiting the findings validity.

Ethical Procedures

Before data collection, I obtained IRB approval to conduct the study from the National Ethics Committee, the Cameroon Baptist Convention Health Board IRB, and Walden University. The Walden University IRB gave me a temporal approval letter to enable me to obtain the national ethics approval. I was required to meet and share summary information about the study and request administrative letters of support before

the issuance of the national ethics approval. I met with key stakeholders and leaders of all the 27 facilities involved in the study to present the research and respond to any questions. This meeting gave them an understanding of the research and enabled them to provide administrative letters of approval for me to collect the data from their sites. One facility required additional approval from the National AIDS Control Committee, which was also obtained. The administrative approval letters were submitted to the National Ethics Committee before they issued the national ethical approval. Before final approval for me to collect data, the national Ethics approval letter was submitted to the Walden University in May 2020. In seeking the IRB approvals, I shared the data abstraction form to be used in data collection from the field and a confidentiality act with the various committees for review and approval. I also signed the confidentiality act before I started data collection. These approval letters were presented to the facilities' leaders and those of the ART clinics, who then gave me access to the registers and medical records. With all the approvals, I did not have any challenges in gaining access to data collection records.

During data collection, I reviewed the medical records and picked out the data required for the study as indicated on the approved data abstraction form, which did not include any identifiable client information but only use codes to identify individual patients. Data collection took place onsite without taking any of the medical records out of the clinic. After using the medical records, I returned them to their sources to be stored in the locked cupboards where they are usually kept while I went away with the data abstraction form. At the end of data collection in each facility, I had an out brief meeting

with the clinic leader to share with him/her what I did, and data collected. I then entered the data from the data abstraction forms into my computer and stored the hard copies in a locked cupboard in my study room. The computer's data was protected with a password and a copy backed-up in an external hard drive with password protection and was stored in my office.

After presenting the study findings and final approval of my dissertation, I will provide written feedback on the study findings to the various health facilities with suggestions for improving services for better outcomes. I will also share summary findings with the regional stakeholders with recommendations and suggestions for improvement based on existing evidence from other countries. At that point, I will destroy the hard copies of the data abstraction forms.

One other ethical issue that could come up in this study was the fact that I will use data from HIV programs while also working on HIV in the country. While this facilitated my access to data, I ensured that all ethical procedures were followed in every site. I explained my trip's purpose and introduced myself as a research student who came for research data collection. I presented the study approval letters, the purpose of the research, and encouraged the service providers to treat me during that visit as they will do for any other researcher.

A summary of chapter three

I described the research design, method of inquiry, study population, participant selection, study variables, data collection, cleaning, analysis plan, threats to the validity

of results, and ethical considerations. The results of the implementation of the study are presented in chapter four.

Chapter 4: Results

Introduction

The purpose of the study was to investigate the association between 12 months retention on ART, the care models used to provide HIV care and related services, and the viral suppression status of C&As in Cameroon. I hoped to generate evidence on retention in care and viral suppression rates for the (C&As) on ART while identifying the care model with the best outcomes. I also sought to establish whether the type of home-based care provider is associated with viral suppression in C&As on ART. The study findings could contribute to the existing literature on the topic and inform program planning, funding prioritization, and national program scale-up strategies that promote specific high-impact interventions.

Research Questions (RQ) and Hypotheses

The study had four main research questions and null hypothesis as follows.

RQ1: Is there an association between the 12 months' retention in HIV care and the HIV care model used for C&As while controlling for age and sex? The null hypothesis stated that “there is no significant association between the 12 months' retention in HIV care and the HIV care model used for C&As on ART while controlling for age and sex.”

RQ2: Is there an association between viral suppression and the HIV Care model used for C&As while controlling for age and sex? The null hypothesis was that “there is no significant association between viral suppression and the HIV care model used for C&As while controlling for age and sex.”

RQ3: Is viral suppression associated with the type of the home-based care provider (the person who supports the child or adolescent at home) among C&As on ART in Cameroon? The null hypothesis for this question was that “viral suppression is not significantly associated with the type of the home-based care provider (the person who supports the child or adolescent at home) among C&As on ART in Cameroon.”

RQ4: Is there a significant difference in the average proportions of the consistency in medication pickup for the different types of home-based care providers among C&As on ART in Cameroon? This question had the null hypothesis that “there is no significant difference in the average proportions of the consistency in medication pickup for the different types of home-based providers among C&As on ART in Cameroon.”

This chapter begins with a brief overview of the study purpose, statement of the research questions, and the null hypotheses. Next is a summary of the chapter’s content and a brief description of how the data were collected. The next section is the descriptive statistics for the various study variables where tables and charts are used to ease understanding. Next is the detailed results presented by the research question with tables, the exact statistics, confidence intervals, effect sizes, and other details for clarity. The chapter ends with a summary of the research findings and a transition into Chapter 5.

Data Collection

Data collection took place from June 2020 to August 2020, following receipt of all the IRB and administrative approvals from Walden University and the national ethics committee in Cameroon. The data collected were documented in the medical records for

participants from January 2019 to December 2019 from participant enrollment in the clinic and updated each clinic visit. As indicated in Chapter 3, there was a slight deviation from the study period (January 2018 to September 2019). This deviation was due to the long delay in obtaining IRB approval and because it was preferable to focus on more recent results for the participants. However, for participants in care for more than 2 years who did not have any documented viral load result in 2019 but had one in 2018, the result of 2018 was collected. Not all clients had data for retention in care and consistency in medication pickup. This missing data was found in the ART registers, which were not available in some sites during data collection because they were being used at the region office for data validation.

The calculated minimum sample size for the study was 1,188, and the total sample collected was 2,503. This difference is because more data was available for eligible participants in the selected study sites than anticipated. The study participants included were C&As aged 0 to 19 years enrolled on ART in study sites for at least 1 year and had at least one viral load test result documented against their name in the ART register or their medical file. The study involved 27 health facilities in five of the 10 regions of Cameroon, which are the Center, Littoral, West, Southwest, and Northwest regions. These regions have used innovative models of care in the past 5 years to manage C&As on ART. The study sites included facilities in the urban and rural areas of the regions. Therefore, the participants drawn from five regions were a good representative sample of C&As on ART in Cameroon, which increased the findings' generalizability.

The data were collected using a data abstraction form and entered an Excel database designed for the study. Only participants with a documented viral load result during the study period were included in the analysis. The data were verified for completeness and consistency, and a codebook generated for the categorical variables before exporting the data into SPSS Version 25 for analysis. In SPSS, the data were again reviewed to ensure that it did not have string variables, had the right labels and values before the analysis.

Descriptive Statistics for the Study Sample

The study had 2,503 participants, and the analysis involved seven key variables, including care model, sex, age, viral load results, consistency of medication pickup, retention in care, and type of home-based caregiver (provider).

Descriptive Statistics for Categorical Variables

There were six categorical variables in the study. Each of the 2,503 study participants belonged to the model of care used in the site. The support group model had the least number of participants ($n = 396$), representing 15.8% of the entire study population. The Standard clinic model had more participants than the support groups ($n = 612$, 24.5%), whereas the child & adolescent friendly clinic model had more than half of the study participants ($n = 1495$, 59.7%).

Table 3

Descriptive Statistics for the Care Model

	Frequency	Percentage
Support group	396	15.8
Standard clinic visit	612	24.5
Child & adolescent friendly clinic	1,495	59.7
Total	2,503	100.0

Information on participants' sex was available for 2,489, and 14 (0.6%) participants had missing data. There were fewer males than females in the study. There were 1,176 males (47%) compared with 1,313 females (52.5%).

Table 4

Descriptive Statistics for Sex

	Frequency	Percentage
Male	1,176	47.0
Female	1,313	52.5
Missing system	14	.6
Total	2,503	100.0

Of the 2,503 study participants, a total of 2,180 had data on the retention status, whereas 323 had missing values (12.9%) due to the unavailability of registers during data

collection. Among the 2,180 participants, 249 were not retained in care, representing 11.4%, whereas 1,931 (88.6%) were retained.

Table 5

Descriptive Statistics for Retention Status

	Frequency	Percentage
Retained	1931	77.1
Not retained	249	9.9
Missing system	323	12.9
Total	2503	100.0

For the type of home-based caregiver, a total of 2,032 (81.2%) participants had valid data, whereas 471 (18.8%) had missing values due to insufficient documentation in the medical files. The “one parent” category had most of the study participants ($n = 851$, 41.9%) and included C&As taken care of by a single mother or single father. This was followed by the “Others” category ($n = 634$, 31.2%), which included all children taken care of by aunts, uncles, grandparents, sisters, brothers, and others. The category of both parents providing care to the C&As had the least number of participants ($n = 547$, 26.9%).

Table 6

Descriptive Statistics for Type of Caregiver

	Frequency	Percentage
Both parents	547	21.9
One parent	851	34.0
Others	634	25.3
Missing system	471	18.8
Total	2503	100.0

For viral load results, the total number of participants analyzed for this variable was N= 2,503, and there was no missing data since it was one of the inclusion criteria for the study. The most recent viral load result for each participant was documented as a continuous variable with values ranging from 0 copies/ml representing an undetectable viral load, while the highest value was 37,800,000 copies/ml. Since one of the dependent variables was viral suppression, the viral load values were recoded into "virally suppressed" with values from 0 to <1000 copies/ml and "virally unsuppressed" with values >1000 copies/ml. A total of n=1,578 participants had viral suppression representing 63%, while n= 925 participants were unsuppressed representing 37%.

Table 7

Descriptive Statistics for Viral Load

	Frequency	Percentage
Suppressed	1578	63.0
Not suppressed	925	37.0
Total	2503	100.0

Age was measured in years with 2,494 participants who had valid data and nine missing values. The youngest of the participants was a year old (Minimum value) while the oldest was 19 years old (Maximum value). The mean age was 11.9 years, the median was 12 years, and the mode was 15 years. The standard deviation was 4.549, the range was 18, and the variance was 20.697. Both Kurtosis and skewness were negative at -0.891 and -0.223, respectively. The age variable was recoded into two categories: 0 – 14 years for children and 15 – 19 years for adolescents. Descriptive statistics showed that 66.5% of the 2,494 participants were children, while 33.5% were adolescents.

Table 8

Descriptive Statistics for Age

	Frequency	Percentage
Children	1,658	66.2
Adolescents	836	33.4
Missing	9	0.4
Total	2,494	100.0

In addition to describing the data by the study variables, data was also disaggregated by region and by zone. Looking at data by region, the Northwest region had the highest number of participants (n=620, 24.8%) followed by the West region (n=593, 23.7%) while the Center region had the least (n=323, 12.9%). The study sites included those from both rural and urban areas referred to as zones. The participants' distribution by zone revealed that the urban areas had more participants than rural areas (55% compared to 45%). This reflects the availability of pediatric ART services, which were mostly limited to big hospitals in the cities until five years ago. I had to include several sites in rural areas to have 45% of participants from there.

Descriptive Statistics for Continuous Variables

The description of continuous variable focused on the valid values, minimum and maximum values, measures of central tendency and measures of variance (Frankfort-Nachmias, & Leon-Guerrero, 2018). Consistency in medication pickup had valid data for 2,198 participants and 305 missing values due to registers' unavailability or incomplete documentation. The minimum value was 8.3%, while the maximum was 100% representing those who picked medication for all the 12 months. The mean was 86.94%, the mode was 100%, and the median was 100%. The standard deviation was 20.488, the variance was 419.76, while the range was 91.7. The skewness was negative at -1.987, while kurtosis was 3,441.

Table 9

Descriptive Statistics for the continuous variable -consistency in medication pickup

		Consistency in med pickup
N	Valid	2198
	Missing	305
Mean		86.943
Median		100.000
Mode		100.0
Std. Deviation		20.4881
Variance		419.764
Skewness		-1.987
Std. Error of Skewness		.052
Kurtosis		3.441
Std. Error of Kurtosis		.104
Range		91.7
Minimum		8.3
Maximum		100.0

The distribution of the continuous variables was examined using a boxplot and a histogram, as shown in Figures 3 and 4.

Figure 3

A box plot for consistency in medication pickup

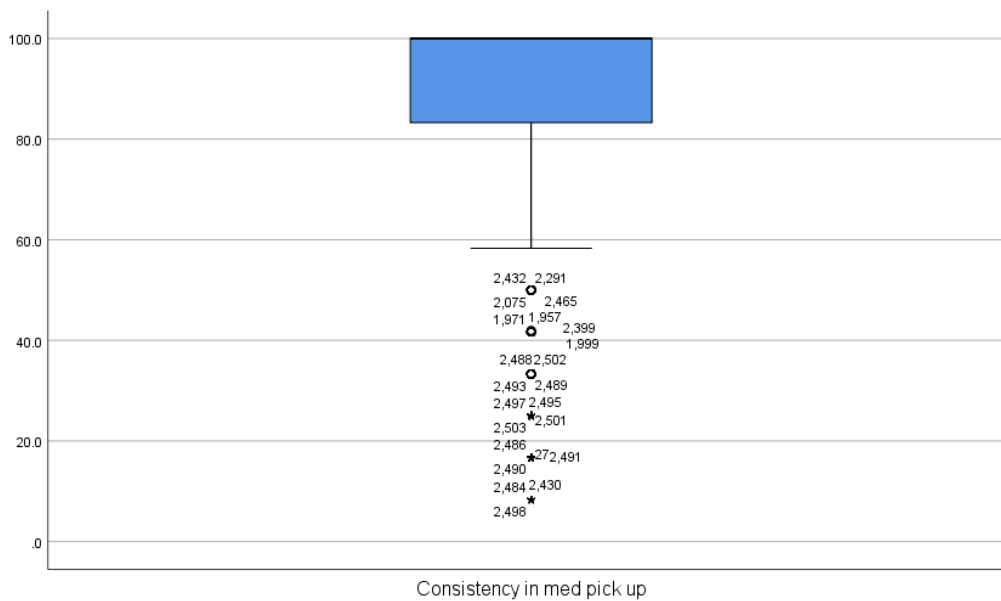


Figure 4

A Histogram of Consistency in medication pickup

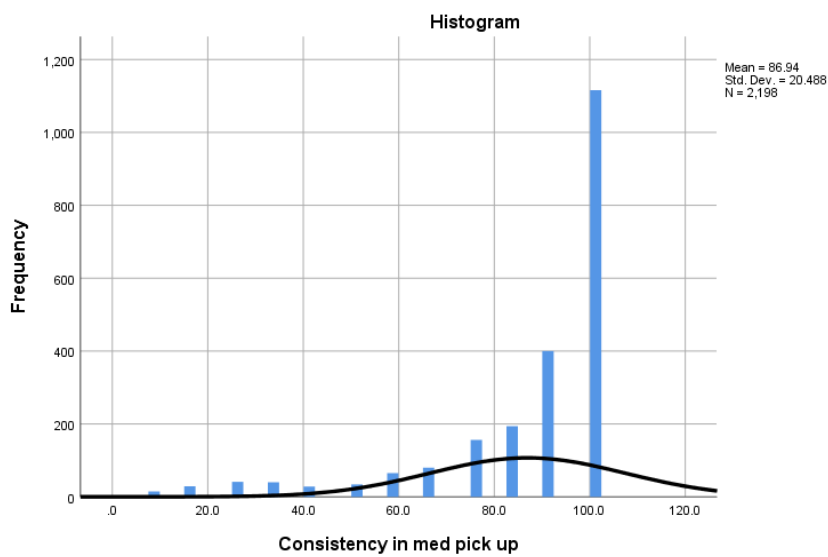


Figure 3 shows a boxplot that had most values in the upper quartile, several outliers in the lower quartile, and the curve highly skewed to the right (negatively skewed), as seen in Figure 4.

Study Results by the Research Questions

The first research question sought to know if there is an association between the 12 months' retention in HIV care and the model of care used for C&As after controlling for age and sex. During data collection, retention in care was recorded as a dichotomous variable with "retained" and "not retained" as the outcomes. For this reason, the Chi-square test and multiple logistic regression were used for analysis to investigate the association between retention and the care model instead of the multinomial regression model proposed in chapter 3. The analysis changed because the 12 months retention in care variable which was previewed to have three categories ended up as dichotomous variable. The Chi-Square test is non-parametric, can determine if there is an association between two categorical variables (retention and care models in this case) and does not require that the data have a normal distribution (Frankfort Nachmias & Leon-Guerrero, 2015). The Chi-Square also provides reliable information on associations if there is the independence of observations and the expected cell frequencies are greater than five (Frankfort Nachmias & Leon-Guerrero, 2015). The data for this study met these assumptions.

While the 12 months retention rate for the study sample was 77.1%, including the missing values, Retention in Care for the SCVs was 87%, followed by that for the SGs (78%) and that for the CAFCS was the least (77%). The chi-square test result revealed no

significant association between the retention at 12 months, and the model of care used for the C&As on ART [$X^2(1, N=2180) = 0.681, p = .711$].

To predict if there was an association between the 12 months' retention in HIV care and the HIV care model used for C&As while controlling for age and sex, a stepwise multiple logistic regression model was conducted. Overall, 88.6% of the study participants were retained in HIV Care, excluding the 323 missing values that constituted 12.9% of the study sample. The baseline binary logistic regression model (Block 0) showed a significant prediction of retention without any exposure variable (Wald statistic of 63.862 and OR= 0.129, $p < .0001$). The Omnibus Tests of Model Coefficients, which compares the model to the baseline (block 0), revealed that the block 1 model was not a significantly better predictor of the relationship between the two variables than the block 0 model ($X^2 = .0001, p = .986$). The block 1 model's output showed no association between the model of care and retention status (OR = 0.998, $p = .986$), confirming what was observed in the Chi-Square test. The OR's confidence interval was from 0.837 to 1.190, including 1, thereby confirming the lack of statistical significance.

Table 10

The Output of Binary Logistic Regression for an association between 12 months retention in care and model of care

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Step 1a								
Care Model	-.002	.090	.000	1	.986	.998	.837	1.190
Constant	-2.046	.146	197.688	1	.000	.129		

The addition of sex separately to the model showed no significant difference in the output. Age as a categorical variable added independently showed no significant association with retention at 12 months (OR=0.795, $p = .122$) with a confidence interval from 0.595 – 1.063, which includes 1. Age did not also have any significant influence on the association between the model of care and retention at 12 months. Putting the predictor variable plus sex and age into the model at the same time still did not show any significant relationship between retention at 12 months and model of care. So, while controlling for age and sex, there was no statistically significant association between retention in care at 12 months and the care model used for C&As in HIV care [OR=1.014 (0.948 – 1.211) $p = .876$]. Therefore, we failed to reject the null hypothesis and did not have enough evidence to conclude that there is a significant association between the two indicators.

Table 11

The Output of Multiple Logistic Regression for an association between 12 months retention in care and model of care while controlling for Age and Sex

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Step 1a								
Care Model	.014	.091	.025	1	.876	1.014	849	1.211
Sex (1)	.151	.135	1.245	1	.265	1.163	892	1.515
Agecoded (1)	.225	.148	2.305	1	.129	1.252	937	1.675
Constant	-2.298	.198	135.053	1	.000	100		

a Variable(s) entered on step 1: Care Model, Sex, Agecoded.

The second research question focused on the association between viral suppression and the HIV Care model used for C&As after controlling for age and sex. The research hypothesis was that there is an association between viral suppression and the HIV Care model used for C&As after controlling for age and sex. The study sample's overall viral suppression rate was 63.6%, and the best suppression rate came from the SG model (68.3%). The CAFCs had a 64.4% suppression rate, while the SCV had a suppression rate of 58.4%. The Chi-Square test for an association between the care model and viral suppression showed a significant association between the two variables, as seen in the data [$\chi^2(1, N=2503) = 9.949, p = .007$]. This suggested that there was a statistically significant association between viral suppression and the models of care. The Cramer's V

test for the strength of the association was 0.63 ($p = .007$). Cramer's V statistic suggested that the model was 63% effective in predicting the relationship between the two variables (Frankfort Nachmias & Leon-Guerrero, 2015).

The output of a binary logistic regression model for the viral suppression and care model showed an overall significant association (OR=0.783, CI: 0.665 – 0.922, $p = .003$), indicating that the logistic regression model predicting the Odds of viral suppression was significant. The output of a binary logistic regression model for viral suppression and sex showed a significant association (OR=0.783, CI: 0.665 – 0.922, $p = .003$) while the association between age and viral suppression was not significant (OR=1.044, CI:0.879 – 1.240, $p = .622$).

A stepwise multiple logistic regression model was again used to determine if the observed association in the binary logistic regression model will change while controlling for age and sex. This was used because the dependent variable, though collected as a continuous variable, was recoded into a dichotomous variable (Dionne-odom et al., 2016), with viral suppression being the outcome of interest. The binary logistic regression model output on the baseline (Block 0) showed that 63% of the study participants were virally suppressed. The baseline model was statistically significant with a Wald statistic of 166.366, and an OR = 0.586 ($p < .000$). The Omnibus Test of Model Coefficients for the model was statistically significant ($X^2 = 9.915$, $p = .007$), confirming that the model was a significantly good predictor of the relationship between the two variables.

Table 12

Binary logistic regression output for viral suppression and Model of care

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Step 1a								
Care Model			9.915	2	.007			
Care Model (1)	-.157	.120	1.719	1	.190	.854	.675	1.081
Care Model (2)	.240	.098	6.011	1	.014	1.272	1.049	1.541
Constant	-.570	.054	112.1	1	.000	.565		

a Variable(s) entered on step 1: Care Model.

Table 13

Categorical Variables Coding

		Frequency	Parameter coding	
			(1)	(2)
Care Model	Support Group	396	.000	.000
	Standard Clinic Visit	610	1.000	.000
	Child & Adolescent Friendly Clinic	1483	.000	1.000
Agecoded	Children	1653	.000	
	adolescents	836	1.000	
Sex	Male	1176	.000	
	Female	1313	1.000	
Viral Sup coded				
	Suppressed	1578	.000	
	Unsuppressed	925	1.000	
Age	Children	1658	.000	
	Adolescents	836	1.000	

Overall, the care model in which the C&As were enrolled had a significant association with the viral suppression status ($p = .007$). Compared to the Support Group model (reference group), the Children & Adolescent Friendly clinics model had a statistically significant association with viral suppression (OR=1.272, CI: 1.049 – 1.541, $p = .014$). After adding the covariate “sex” to the model, it still showed a significant

association between the variables (viral suppression and model of care) with similar Odds Ratios and the confidence interval plus a slight increase in alpha ($p = .024$). The variable sex in the model was also significantly associated with viral suppression (OR= 0.788, CI:0.669 – 0.928, $p = .004$). Upon adding the variable "age" into the model, both the association between the Child & Adolescent Friendly corners and sex remained significant. In contrast, age did not show any significant association with viral suppression both in the binary and multiple logistic regression models (OR=1.078, CI: 0.905 – 1.283, $p = .399$).

Table 14

Multiple logistic regression output for viral suppression and Model of care while controlling for age and sex

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
Step 1a								
Care Model			9.666	2	.008			
Care Model (1)	-.165	.120	1.878	1	.171	.848	.670	1.073
Care Model (2)	.235	.100	5.581	1	.018	1.265	1.041	1.538
Sex	-.239	.083	8.180	1	.004	.788	.669	.928
Agecoded	.075	.089	.710	1	.399	1.078	.905	1.283
Constant	-.465	.078	35.981	1	.000	.628		

a Variable(s) entered on step 1: Care Model, Sex, Agecoded.

From the statistics, sex had an independent association with viral suppression both as a standalone variable and when combined with the model of care, while age had no statistically significant association in both scenarios. Sex modified the association between viral suppression and the care model only slightly by reducing the Odds Ratio from 1.272 (1.049 – 1.541) to 1.250 (1.030 – 1.516). The final output for the multiple logistic regression model showed that C&As enrolled in the Child and Adolescent Friendly clinics had an odds of being virally suppressed, which was 1.265 times higher than that for children in the support group model was statistically significant at $p = .018$. Also, sex was significantly associated with viral suppression, and females were 0.788 times more likely to be virally suppressed than males.

Summarily, there was a significant association between viral suppression and model of care for C&As in HIV care while controlling for age and sex. Sex had an independent statistically significant association with viral suppression, whereas age did not. The odds of achieving viral suppression were 1.265 times higher in C&As enrolled in the CAFC model than those enrolled in the SG model. With these findings, the research hypothesis of an association between viral suppression and care models was accepted and the null hypothesis of no association between the two variables was rejected.

In the third research question, the focus was on the association between viral suppression and the type of home-based caregiver (the person who supports the child or adolescent at home). The Null hypothesis was that there is no association between viral suppression and the type of home-based care provider for the C&As in care. The outcome

variable was viral load status recoded into "virally suppressed" and "virally unsuppressed" with viral suppression as the outcome of interest. The type of home-based care provider had three options, including "both parents", "single parent," who was mother alone or father alone, and "Others" (foster parents), including grandmother, sister, uncle, aunt, and other categories as found in the field.

The viral suppression rate for all the study sample (N=2,038) was 66.1%, with the highest seen in children who had both parents as the caregiver (67.0%), followed by the single parent category (66.9%) and then others with 64.4%. From observation, the viral suppression rates were similar across the three types of care providers, with a difference of less than 3%. A binary logistics regression model revealed no statistically significant association between viral suppression and the type of home-based care provider (Wald statistics of 1.123 and $p = .570$). This model was well fitted, as seen in the statistically significant baseline Wald statistics of 196.928 ($p < .0001$) and the statistically insignificant Chi-square for the Omnibus Test of Model Coefficients ($X^2=1.119$, $p = .571$). Though not initially included in the hypothesis, sex and age were added to the model to see if they may mediate the relation between viral suppression and type of caregiver at home, but there was still no significant association. Therefore, the alternative hypothesis of an associated between viral suppression and type of home-based caregiver was rejected. The null hypothesis of no association was accepted because I did not find enough statistical evidence to conclude that there is a significant association between the two indicators.

Table 15

The Output of Binary Logistic Regression for an association between viral suppression and the type of home-based care provider

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
Step 1a								
Type of Caregiver			1.123	2	.570			
Type of Caregiver (1)	.010	.116	.007	1	.933	1.010	.804	1.268
Type of Caregiver (2)	.112	.123	.831	1	.362	1.119	.879	1.423
Constant	-.696	.091	58.81	1	.000	.499		

a Variable(s) entered on step 1: Type of Caregiver.

The fourth research question was on the association between proportions of the consistency in medication pickup and the home-based care provider type. The alternative hypothesis stated that "there is a significant association between the proportions of medication pickup and type of home-based care provider for C&As in Cameroon." Consistency in medication pickup was measured as a continuous variable, and proportions calculated from the number of months out of the 12 months of the year that the C&As picked medications. The average proportion of consistency in medication pickup was 85% for all the three types of home-based care providers, unlike what was expected. I planned to use the One-Way ANOVA statistical test to compare the means proportions of the consistency in medication pickup by type of home-based caregiver. However, upon examining the data, the distribution was not normal and was negatively

skewed (skewness = -1.987). The test for normality showed significant p -values for the Shapiro-Wilk statistic for all three groups indicating the inappropriateness of the One-Way ANOVA test. I transformed the values into logarithm values, but the distribution was still not normal. I therefore decided to use the Kruskal – Wallis statistical test, which is non-parametric, to compare the means in the three groups and see if they are the same. The Kruskal – Wallis Statistics was 1.243, $p = .537$. I did not carry out multiple comparisons because of the non-statistically significant result indicating that there is no significant difference across the groups. Therefore, I failed to reject the null hypothesis and did not have enough evidence to conclude that the distribution of the consistency in medication pickup is significantly different across the categories of type of home-based caregiver.

Table 16

The Output of a Kruskal – Wallis test for a significant difference in the proportion of consistency in medication pickup across the types of home-based care provider

Consistency in Medication pickup	
Kruskal-Wallis H Statistic	1.243
Df	2
Asymp. Sig.	.537

In addition to responding to the research questions, I also looked at the data by site, zone, and region. There were statistically significant differences by the site ($F = 4.029, p < .0001$), by zone ($F=5.691, p = .017$) and by region ($F = 6.617, p < .0001$).

These results will be exploited further subsequently as they may reveal additional information that may strengthen program implementation.

Summary of study findings

The study data analysis generated evidence to reject the null hypothesis for one research question and failed to reject it for some. I failed to reject the null hypothesis in the first research question because there was no statistically significant evidence of an association between retention in HIV care at 12 months and the model of care while controlling for age and sex. Age had an independently significant association with retention in care but did not have a statistically significant influence on the association between retention and the care model. Sex had no significant influence in the model and failed to have an independent statistically significant association with retention. For the second RQ, I found a statistically significant association between viral suppression and care model while controlling for age and sex. The odds of viral suppression were 1.265 times higher in C&As enrolled in the Child and Adolescent Friendly clinic model than those enrolled in the support groups model while controlling for age and sex. I, therefore, rejected the null hypothesis of no association between viral suppression and care models while controlling for age and sex.

The analysis in response to RQ3 found no statistically significant evidence to reject the null hypothesis of no association between viral suppression and the type of home-based care provider (Chi-square for the Omnibus Test of Model Coefficients ($X^2=1.119, p = .571$). In the same light, the Kruskal – Wallis test conducted to answer RQ4 generated an Kruskal - Wallis-statistics of 1.243 ($p = .537$). There was therefore no

significant association between viral suppression and the type of home-based caregiver. The alternative hypothesis of an association between the proportion of consistency in medication pickup, and the type of home-based caregiver rejected and the null hypothesis of no association between the two variables was accepted. Therefore, the null hypothesis for the four research questions was rejected only for RQ2, and there was no evidence to reject the null hypothesis for RQ1, RQ3, and RQ4.

The next chapter (chapter 5) will discuss these findings, conclusions based on the results, limitations of the study, recommendations for further research, implications for practice, and social change implications.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of this quantitative retrospective cohort study was to explore whether retention in HIV care and viral suppression are associated with the model of care used in the clinics and the type of home-based care provider who supports the C&As in Cameroon. The objective was to compare the two outcomes (retention in care at 12 months and viral suppression) for the three models of care used in pediatric and adolescent clinics with the hope of identifying the model and type of care provider with the best retention in care and viral suppression rates. The three models of care were SGs, SCVs, and the CAFCs. The second research objective was to explore if the type of care provider at home (both parents, single parent, and foster parents) is associated with viral suppression in C&As on ART in Cameroon. The study had just two covariates, age and sex, because these had documented data in the data sources used. The initial hypotheses were that C&As enrolled in the CAFCs where there has been much investment in recent years, and those taken care of at home by their biological parents will have better outcomes than others.

This study was a quantitative study in which a retrospective cohort review approach was used to abstract and analyze data from existing secondary data sources in the clinics for C&As (0-19 years old) who were current on ART in Cameroon from January 2019 to December 2019. I selected this study design due to the convenience of using existing data, saving time, and cost. The retrospective design was also preferred because the objective was to work with data collected from routine care settings,

representing the real situation. There were three dependent variables (12 months retention in care, viral suppression, and consistency in medication pickup), two independent variables (model of care and type of home-based care provider), and two covariates (age and sex) involved in the study. The data for each of these variables was available either in the ART registers or the individual medical records existing onsite.

I used a data abstraction form to collect data from the study sites for participants who were C&As (0-19 years old) enrolled on ART and who were eligible for inclusion in the study. One key inclusion criterion was the presence of a documented viral load result within the study period. The most recent viral load result was considered for participants who had more than one. The collected data were entered into an Excel database and exported to SPSS Version 25 for analysis. The statistical tests used depended on the research question and included the chi-square test, binary and multiple logistics regression, and the one-way ANOVA test. Some of the study findings were not as hypothesized, as seen in Chapter 4.

The need to prioritize and target appropriate health interventions that significantly impact the population necessitated this study. This prioritization is more critical in settings with competing health priorities such as Cameroon and other countries in SSA, which are the hardest hit by HIV but have limited resources to fight the pandemic (Zakumumpa et al., 2017). Findings from this study will hopefully contribute in filling the gap in the literature in the understanding of which model of care yields the best outcomes in a routine care setting and will equally open up other areas for research given

the limited existing literature on some aspects of this study such as the role of the home-based care provider.

The study data analysis generated evidence to reject the null hypothesis for the second research question only. The results for Research Questions 1, 2, 3, and 4 instead showed evidence to accept the null hypothesis. Therefore, based on the study data, there was no statistically significant evidence of an association between retention in HIV care at 12 months and the care model while controlling for age and sex [OR=1.014(0.948 – 1.211), $p = .876$]. There was a significant association between viral suppression and care model while controlling for age and sex [$X^2(1, N = 2503) = 9.949, p = .007$]. More specifically, the analysis showed that the odds of achieving viral suppression was 1.265 times higher in C&As enrolled in the CAFC model compared with those enrolled in the SG model. There was no statistically significant evidence for an association between viral suppression and home-based care provider ($X^2 = 1.119, p = .571$). Last, I also did not find any evidence of an association between the proportion of consistency in medication pickup and type of home-based care provider ($F = 1.576, p = 1.93$).

Interpretation of the Findings

This study's findings confirm and diverge from what was hypothesized and what exists in the literature on retention in HIV care and viral suppression. This section contains a review of the findings and their interpretation compared to previous studies by the research question.

The 12-Month Retention in Care and Models of Care

Retention in care is a critical step in the HIV care cascade since people need to stay in care and adhere to treatment to achieve viral suppression and live healthy lives. A successful HIV program is one with good retention in care, and the services offered in the clinic could be a good attraction for C&As to stay in care. While controlling for age and sex, retention in care at 12 months showed no statistically significant association with the three care models (OR = 0.998, 95% CI: 0.837 to 1.190, $p = .986$). Therefore, none of the care models had a significantly higher retention rate compared to others.

In the CAFCS model, participants received monthly age-adapted education. They had much interacting among themselves, similar to the adherence clubs, family clinic days, and decentralized care services, which showed better outcomes in Uganda and South Africa (Fox et al., 2019; Graves et al., 2018; Tsondai et al., 2017). These authors found a statistically significant association between care models introduced as quality improvement interventions and improved retention in care. Still, they only compared their intervention to the standard clinic visit. This study compared three models of care and used secondary data from a routine care setting. It was not possible to control for the several other factors which are associated with retention in care for C&As such as the availability of the medications, compassionate service providers (Cluver et al., 2018), long distances, cost of transportation and insurance (Yehia et al., 2015). A prospective study in routine care settings that controls for all these possible associated factors may yield more reliable results when the models of care are compared.

A previous study conducted in the ten regions of Cameroon in 2014 found a 12-month retention rate of 60.4% with no difference between adults and children (Billong et al., 2016). Another study found low viral suppression in big hospitals than small clinics (Tchouwa et al., 2018). This research, which focused only on C&As and covered five of the 10 regions, recorded a retention rate of 77.1%, including the care model's missing values and retention rates by model of 77%, 87%, and 78% for CAFCS, SCV, and SGs, respectively. Though there was no statistically significant difference in the retention rates by model, the least retention rate was in the CAFCS, which were mostly in the large hospitals with more prominent pediatric HIV clinics and much investment. This CAFCS was also the model with the highest number of participants. Because pediatric care services were mostly centralized in these large hospitals until a few years ago, outlying health facilities in the remote areas had to refer C&As in need of ART to the big hospitals for care. Possible predictors of these results, which were not included in this study and might have contributed to the low retention rates for C&As in CAFCS than expected, are challenges of long distances, bad roads and high cost of transportation, need to visit clinics monthly, and the need to be accompanied by care providers. It is worth conducting further studies, including qualitative studies, to understand the role of some of these factors in retention in general and in these big pediatric ART clinics specifically. In this study, age had a significant independent association with 12 months of retention in care (OR = 0.969, $p = .034$). Still, it did not significantly influence the association between retention and the model of care. Investigating the associations in children compared with adolescents may yield different results and constitute a topic for further research.

Viral Suppression and Models of Care

I found a statistically significant association between viral suppression and the models of care (OR = 0.783, CI: 0.665 to 0.922, $p = .003$), which enabled me to reject the null hypothesis of no association as anticipated. Routine clinic visits had the lowest viral suppression rate, pointing to more psychosocial support and clinical monitoring of the C&As in care. The psychosocial and peer support found in the SGs and CAFCS is absent in the SCVs. A randomized control trial conducted in Uganda and Kenya by Dalsone Kwarissima et al. (2017) found improved retention rates and viral suppression in comparing a streamlined care model to standard care. This study was not an RCT and did not see a significant difference in the model's retention rates, which does not align with Uganda and Kenya's study. The general belief is that if there were no significant differences in retention by the model of care, there should not also be a difference in viral suppression by the model of care using the same data within the same period. Patients who are retained in care are likely those who have been consistent on treatment and should have higher probabilities of achieving viral suppression. Interestingly, this study does not support the thinking and points out that being retained in care is not synonymous with taking medications as prescribed or taking the right medications. The patients need to be on the right medications, right doses, and take them as prescribed to achieve and sustain viral suppression.

Many efforts were made to improve viral suppression rates and viral load coverage in the last two years in Cameroon. The government's decision from January 2020 to offer free viral load testing to all in need is an excellent opportunity to increase

coverage. Viral load coverage has been notably lower for C&As compared with adults (Arpadi et al., 2017; Ferrand et al., 2017). It is rampant in Cameroon to have health facilities managing C&As go out of stock of medications for some months. Children often change the regimen to what is available, some have repeated high viral load results, and there is the possibility of viral rebound (Teasdale et al., 2018). Several C&As in care have not done a viral load test, and some not yet on ART. Strengthening HIV case finding in children, enrolling those HIV positive on ART, and scaling up viral load testing for those eligible is important. There is also a significant need to improve the use of results to better manage the C&As in care for improved viral suppression rates if there is hope for an HIV free generation in the future.

The overall viral suppression rate for the study was 63.6%. A previous study carried out in Cameroon found 72% for a cohort of patients who had been on ART for 12 – 24 months (Tchouwa et al., 2018). Another study conducted in one hospital in Yaounde involving 71 children aged 2-18 years on protease inhibitor-based ART recorded a 74.7% viral suppression rate (Nlend et al., 2019). The viral suppression rate from CAMPHIA was 70% (CAMPHIA, 2018). While the CAMPHIA and the study by Tchouwa and his team covered both adults and children in the whole country, the study from the hospital in Yaounde focused on children but had a small sample, focused only on a specific regimen, and was not representative of the population of C&As on ART. To a great extent, these findings represent the country's actual situation, as seen in the sample size, geographic coverage, and the participants were from a routine care setting, including those from big and small hospitals from both rural and urban areas.

Previous literature documents lower viral suppression rates for children than adults attributed to various factors, including their dependence on care providers for their care (Closson et al., 2019; Enane et al., 2018). Their dependency nature increased their risk of defaulting or getting lost-to-follow-up. One Cameroonian study attributed the low rates of viral suppression in children to limited knowledge of health care workers in managing the C&As on ART (Penda et al., 2019). The service providers in the clinics with CAFCS received more training and technical support in the management of the C&As compared to smaller centers with fewer C&As. Most often, the C&As also receive a closer individual follow-up, transport subsidies for group meetings, and sometimes their care providers were invited for educative meetings to improve their management of the C&As at home. The study findings suggest that it may be essential to consider investing in some of these strategies in pediatric clinics for improved outcomes in C&As. Notwithstanding, the viral suppression rate even in the C&As benefiting from these interventions was still less than 70% (far less than the desired 90%) which casts doubts on their effectiveness. It may be essential to review the care package's content in the SGs and CAFCS to identify why the viral suppression rate in these models is still suboptimal though better than that of the SCVs.

Viral suppression and type of home-based care provider

In this study, there was no statistically significant association between viral suppression and the type of home-based care provider. Therefore, the viral suppression rates for the C&As did not differ much by the kind of home-based care provider (67.0% for both parents, 66.9% for single parents, and 64.4% for foster parents). A study

conducted in Asia found out that C&As were more likely to default from care if they were living with other care providers who were not their biologic parents (Huy et al., 2016), which is what several stakeholders and service providers in Cameroon think is responsible for high viral load in children. The study conducted in the hospital in Yaounde found out that 22 of the 71 C&As were orphans, and being an orphan was not associated with viral suppression (Nlend et al., 2019). The findings from the Asian study and the Yaounde hospital study are contradictory but not comparable, given the sample sizes and representativeness of the Yaounde study sample. These findings confirm the Yaounde study's finding and are likely to be challenged by many stakeholders who believe that orphanhood is a risk factor for high viral load. These findings should stimulate further research, including qualitative studies on the topic, which may uncover other underlying factors that contribute to the high viral load even in C&As living with their biological parents, some of whom are also on ART.

Medication pickup and type of home-based care provider.

For the consistency in medication pickup, the hypothesis was there is a significant difference in the average proportions of the consistency in medication pickup for the different types of home-based providers among C&As on ART in Cameroon. Feedback from interactions with pediatric service providers suggests that parents taking care of their children on ART are more likely to follow-up, keep to the appointment dates, avoid missed opportunities compared to foster parents who have other responsibilities. These findings showed no statistically significant difference in the proportions of medication pickup in the three groups, and single parents constituted 42% of their home-based care

providers. Some studies in the literature have documented family stability associated with adherence to ART (Shabalala et al., 2016; Sherr et al., 2016). Another study highlighted the burden of home-based care for children living with HIV (Osafo et al., 2017), which may be more bearable to biological parents than other care providers or single parents. In some sites, most of the care providers were grandmothers, uncles, and aunts.

Interestingly, they were able to remember to go to the clinic for medications, remind the C&As to take the medicines, like what happened in the “both parents” category. The lack of an association between viral suppression and type of home-based caregiver was identical to results of a study conducted in India, which compared the quality of life in children living in foster homes to those living with their parents and found no significant difference (Kamalakshi et al., 2018). The contradiction in the evidence suggests that there may be other associated factors that further research needs to uncover concerning care providers of C&As on ART.

Study Findings in the Context of the SCT

The theory that guided this study was the SCT, which was first articulated by Albert Bandura (Bandura, 1986). It highlights the importance of critical concepts such as personal standards, self-reflection, self-regulation, environmental circumstances, and influence on behavior, suggesting that external and internal factors cause people to regulate their behavior following cognitive processes and environmental manipulations (Mulhollem, 2017). The care model in which the C&As were enrolled and the environmental manipulations and the care psychosocial support received could influence their behavior and eventual viral suppression status.

The study found an association between viral suppression and care models, which aligns with the theory, pointing to the need for more friendly environments in the ART clinics for C&As. The therapeutic education in the CAFCs and SGs seems to have played a key role in improving treatment literacy and regulating behavior towards taking the ARVs leading to higher viral suppression rates. Evidence from existing literature showed an increase in understanding why quality care for C&As improves outcomes and self-efficacy (Bröder et al., 2017). These are attributes of the SCT and core aspects of the care package in CAFCs. The findings did not show that the type of home-based care provider matters in viral suppression. The single and other foster parents managing the children likely did their best to provide a supportive environment at home, favoring taking medications and medication pickup, like what the children with both parents also received.

Limitations of the Study

The study used existing data, which saved time and cost. However, it was prone to several limitations common in longitudinal studies. For instance, all participants receiving care from a clinic that uses a particular care model were attributed to that model of care even if they did not consistently receive all the model's services, which could introduce bias. The study variables were limited to data routinely collected and documented in the sites' medical records, which was a limitation because other covariates, which might have influenced the observed associations, such as the level of education or the home-based care providers' socioeconomic status, were not included due to lack of existing information.

Documentation of services offered in ART clinics is usually a challenge. Some of the files did not have complete information during data collection, while some had long-outdated information. For example, in some clinics, many files did not have the information on the C&As care provider. Some service providers knew these individual care providers and worked with them to manage the C&As but did not document it. Hence, it could not be collected. Limited documentation at enrollment, which might have changed with time led to the missing values. I had to gather only the data reported in the records, as indicated in the study data collection plan. The documentation gaps led to high numbers of missing values for some indicators, which might have influenced the results.

HIV Case identification and ART uptake in Cameroon is not yet optimal. This study included only children enrolled in care and did not include those living with HIV in the community whose status is unknown and those already tested HIV positive but not yet on ART. However, some of these children may not be in care due to their family status, long distances to ART clinics, high transport costs, and many other factors. This limits the generalizability of the findings to the general population. As a retrospective study, data collected was based on what was available, which did not give the same sample in each subgroup. The imbalance in study participants in each group could influence the results and the interpretation of findings.

The study included only participants who had at least a documented viral load result during the period, which excludes those who did not have a viral load result. These

C&As without viral load might have different experiences and may be more likely to default from care than those in the study.

Recommendations for further research

The variables in this study were limited to what was available in the medical records onsite. A prospective study conducted in the same setting, which includes all possible predictors of retention, as seen in previous studies in addition to the model of care, may yield more reliable results. This is because data will be collected for possible confounders and effect modifiers which will all be included in the analysis. The level of investment in some care models calls for distinct outcomes. Otherwise, it may not be worth investing much in such models to achieve similar retention by the care model.

Retention in big pediatric clinics seems to be a big issue, and since these clinics have large numbers of C&As, their performance pulls down that of the entire country. Conducting qualitative studies to understand C&As' plight and risk factors hindering retention despite all the investment is worthwhile. It may be essential to review the content of the care packages in the SGs and CAFCs and the level of fidelity they are implemented to identify why the viral suppression rates in these models are still suboptimal (<70%).

There is a need to investigate whether associations between the independent variables in children compared to adolescents may yield different results and constitute a topic for further research. It was interesting to see that viral suppression did not differ by type of home-based care provider. Additional research, including qualitative studies on the topic, may uncover other underlying factors that contribute to the high viral load even

in C&As living with their biological parents, including some of the parents on ART. A further investigation into the package of services offered by each type of home-based care provider to the C&As and a review of the home environment without assuming that biological parents will do better than foster parents could also reveal significant findings that will contribute to the existing literature.

Implications for Positive Social Change

This study's findings are likely to stimulate further research in line with the recommendations outlined, leading to a positive change in the HIV domain. The results also can impact social change at the clinic, community, and health system levels. At the clinic level, the providers and care providers, upon receipt of the results, will be more determined to strengthen clinical and psychosocial services to improve retention and viral suppression in care while documenting all reasons for any client who will not be retained. All providers in the SCV model will likely seek to bring the children together for peer support since it is crucial in the other models. The dissemination of the findings in various sites will likely rekindle interest and commitment to pediatric HIV services onsite, and service providers will strengthen C&As' management for better outcomes. Service providers will likely enhance their knowledge of and collaboration with the home-based care provider of every C&As for improved adherence and psychosocial support at home.

At the community level, the study findings may strengthen knowledge on the need for children living with HIV to stay healthy, the importance of being consistent on ART, and the importance of viral load monitoring, which tells how successful the HIV program

is. The increase in knowledge may increase the free of charge viral load testing since caregivers may begin requesting viral load sample collection for their C&As. As many more of the C&As do the viral load test when eligible, achieve sustained viral suppression, they will live healthy lives. Consequently, they will attend school regularly, their care providers will spend less money on health, less time in hospitals, and have more time to work and generate money for other family needs.

There will be discussions of the findings at the organizational level that may lead to some redirection of funds to provide more support to C&As receiving care in the SCVs while strengthening supervision in the clinics with SGs and CAFCs to increase efficiency. New targets will likely be set for each clinic to achieve improved retention and viral suppression in the new year with improvement action plans drawn for each site. Home-based care providers will likely be brought together for education and peer support to strengthen their understanding of the role they must play to improve retention and viral suppression in the C&As. Their increased knowledge and involvement will likely improve the outcomes and increase the quality of life for the children and the community. This may lead to the generation of some 'communities of practice," which will become best practices for emulating by others.

At the health system level, the study findings are likely to cause the national pediatric HIV technical working group to rethink about the national pediatric HIV program, discuss study findings, other strengths and weaknesses and strategize for improved outcomes, which should include strengthened supervision and technical assistance, especially in the health facilities in remote areas. Improved services in the

health facilities in remote areas will limit referrals to big hospitals, reduce distances, and cost transport, reducing defaulting, consequently improving retention. Strengthened supervision and improved quality of care in the remote facilities in improving retention may also improve viral suppression rates, enabling the country to progress towards achieving the third 90 UNAIDS goal, aiming to have at least 90% of all patients on ART virally suppressed.

The study was a retrospective study conducted within a short period with findings that are likely to generate several debates and further research around pediatric HIV services. According to the existing literature, few operational research studies are conducted in Cameroon compared to countries in East Africa, likely because potential researchers believe that much money is required to do a study. The design and findings from this study prove that operational studies are feasible with some effort and limited funds and could serve as evaluations of existing interventions and generate findings that may lead to policy change. It is likely that within the next year, there will be several other studies conducted in this domain to extend knowledge or counter these findings while contributing to the existing literature on the topic. The scale-up in operational research and the use of study findings for program improvement will increase the HIV program's visibility, leading to positive social change. Additionally, studies that identify best practices, strategies, and whose findings are used to improve program outcomes will improve the study participants' quality of life and positive social change in the communities.

Conclusion

People living with HIV and on ART need to stay in care, take their medications consistently, and achieve viral suppression, which will keep them healthy and reduce viral transmission. Unfortunately, the retention and viral suppression rates in C&As have been suboptimal despite efforts to improve them in Cameroon. This study examined the association of the model of care and the type of home-based care provider to retention at 12 months and viral suppression while controlling for age and sex. Findings showed that the children enrolled in CAFCs had a higher viral suppression rate compared to the other models, pointing to the need to strengthen clinical management and psychosocial support for the C&As at all levels. The care model did not seem to have an association with the 12 months retention in care. The type of care provider at home did not also affect viral suppression and consistency of medication pickup. A better understanding of the models that yield better results, the care package's content, and home-based care providers' role are essential. The translation of this understanding into remediation action plans for effective implementation may speed up progress towards the UNAIDS third 90 in Cameroon and promote positive social change in the HIV community.

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