REPUBLIC OF NAMIBIA
MINISTRY OF HEALTH AND SOCIAL SERVICES

Evaluation of Community-Based Antiretroviral Therapy in Okongo and Eenhana Districts of Namibia 2007–2017

NAMIBIANS AND AMERICANS IN PARTNERSHIP TO FIGHT HIV/AIDS
PEPFAR

Republic of Namibia

Ministry of Health and Social Services

Evaluation of Community-Based Antiretroviral Therapy in Okongo and Eenhana Districts of Namibia, 2007–2017

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FOREWORD

Namibia's Ministry of Health and Social Services (MoHSS) is committed to decentralizing service delivery to remote and peripheral communities in order to take services closer to where the people live. As a country, Namibia has made significant progress in control of the HIV epidemic and is close to achieving the UNAIDS 95-95-95 targets, which are similar to the targets outlined in the National Strategic Framework for HIV and AIDS Response in Namibia for 2017–2022. To achieve these ambitious targets, the ministry has implemented differentiated service delivery models that are patient-centered and that also, to a certain extent, address health system challenges. The differentiated service delivery models are evidence-based interventions aimed at improving patient retention and reducing the burden of care on patients and the health system. The implementation of the community-based ART program in Okongo was a good example of empowered communities' taking care of their own health, and this idea led to expansion to other communities.

This is the first-ever evaluation of the community-based antiretroviral therapy (C-BART) program in Namibia. Although the program was started in 2007, it became more visible around 2013–2014, and evaluation advocacy and planning began in 2016. The evaluation of treatment outcomes for adult and pediatric clients in the C-BART model will inform further expansion and program improvement. The ministry is eager to implement recommendations from this report and to engage and empower community-based workers and patient-led groups to effectively and efficiently utilize community-owned resources to improve access to health services and thereby improve people's quality of life, in line with the MoHSS strategic plan, the goal of universal health coverage, and the UN Sustainable Development Goals. The release of this report is a clear sign of the MoHSS's and the government of Namibia's determination to share best practices and contribute scientifically to the body of knowledge on differentiated care models implemented in various settings with limited resources and among various age groups, including children.

The MoHSS is thankful for the political leadership that the government of Namibia continues to provide to the HIV response in this country. It is this support and commitment that allow for strong partnerships and collaborations with civil society, donor organizations, and multilateral and other developmental partners that are working side by side with the MoHSS and other entities to achieve epidemic control in Namibia. Namibia is proud to be leading the way in Africa toward total control of the HIV epidemic. The MoHSS appreciates all the organizations, clients and their facilities, and individuals who contributed to the success of this report.

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Dr. Kalumbi Shangula

Minister of Health and Social Services, MP

PREFACE

Namibia is one of the countries most impacted by the HIV/AIDS epidemic. Despite the daunting task of fighting the epidemic, the country has made remarkable progress toward achieving epidemic control. The results of the 2017 Namibia Population-Based HIV Impact Assessment clearly demonstrate that the country is at the cusp of achieving the UNAIDS 90-90-90 targets [1]. As the country reaches epidemic control targets, the MoHSS is committed to implementing sustainable service delivery models that are patient-centered and that ensure high-quality patient outcomes.

Most people living with HIV in Namibia receive care and treatment from the nearest public health facilities. The groundbreaking community-based antiretroviral therapy (C-BART) service model was introduced by nurses in Okongo District in 2007 and later expanded to Eenhana District to address the issues that were preventing many people from accessing appropriate HIV care. The rapid scale-up of HIV treatment and the 2016 implementation of the World Health Organization's test-and-treat strategy (known in Namibia as "treat all") necessitated roll-out of the community-based approach to other parts of the country. In collaboration with partners, the MoHSS sought to conduct a comprehensive evaluation of the C-BART program in the two districts in order to inform potential scale-up of the community-based approach as a strategy to achieve treatment targets.

A team that included experts in quantitative, qualitative, and costing studies from the U.S. Centers for Disease Control and Prevention (CDC), EGPAF, and the Namibia Ministry of Health and Social Services (MoHSS) conducted the evaluation of the C-BART program in Okongo and Eenhana Districts.

The results of the evaluation show that both adults and children living with HIV who were getting treatment at the C-BART sites had higher rates of retention in care, adherence to treatment, and viral suppression than the national average. In addition to the improved retention and adherence at the C-BART sites, in-depth interviews with patients show that the community-based service model has gained acceptance over time by reducing the cost of transportation for patients while also saving their productive time. Similarly, health care providers confirmed that the program alleviates severe overcrowding and reduces the high workload at health facilities. However, the results also highlight major challenges of the C-BART program: lack of privacy, lack of infrastructure, inconsistent arrival times of health care workers, lack of standard operating procedures, weak monitoring and evaluation systems, and inadequate training for health extension workers and nurses involved in C-BART. Overall, the evaluation demonstrates that the C-BART program was effective in terms of retention, adherence, and viral suppression, with reasonable costs, and led to a reduced burden on health facilities.

This evaluation report provides the MoHSS and its stakeholders with the necessary evidence base for scaling up this model of care. I urge all program managers and other stakeholders to make use of the findings and recommendations in this report in order to improve the services offered to our clients and, ultimately, to improve our clients' clinical outcomes.

The ministry would like to acknowledge the development partners, particularly the CDC and EGPAF, who supported this evaluation and the C-BART program. Special appreciation goes to the technical staff in Okongo and Eenhana Districts, who made the C-BART services a success.

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Mr. Benetus Nangombe

Executive Director, MoHSS

ABBREVIATIONS

3TC	lamivudine
ART	antiretroviral therapy
ARV	antiretroviral
AZT	zidovudine
CAG	community adherence group
C-BART	community-based antiretroviral therapy
CDC	U.S. Centers for Disease Control and Prevention
DOB	date of birth
DRC	Democratic Republic of the Congo
EDT	electronic dispensing tool database
EFV	efavirenz
EGPAF	Elizabeth Glaser Pediatric AIDS Foundation
ePMS	electronic patient monitoring system
FGD	focus group discussion
HCW	health care worker
HEW	health extension worker
HIV	human immunodeficiency virus
IDI	in-depth individual interview
IQR	interquartile range
LTFU	lost to follow-up
M&E	monitoring and evaluation
MoHSS	Ministry of Health and Social Services (Namibia)
NAD	Namibian dollar
NIMART	nurse-initiated and -managed antiretroviral therapy
NIP	Namibia Institute of Pathology
NVP	nevirapine
PCB	patient care booklet
PEPFAR	U.S. President's Emergency Plan for AIDS Relief
PLHIV	people living with HIV
PRL	probabilistic record linkage
RA	research assistant
TDF	tenofovir disoproxil fumarate
UNAIDS	Joint United Nations Programme on HIV/AIDS
USD	U.S. dollar
VL	viral load
WHO	World Health Organization

DEFINITIONS OF KEY TERMS

Adult: An individual age 15 years or older.

C-BARTs: Places where community-based antiretroviral therapy (ART) services are implemented. A team of health care workers from the hospital visits these places on a predefined schedule to provide appropriate health examinations and ART refills to patients who have gathered there for that purpose.

Deaths: Reports in the electronic dispensing tool database and/or electronic patient monitoring system of a patient's having died.

Differentiated care: "A client-centered approach that simplifies and adapts HIV services across the cascade to reflect the preferences and expectations of various groups of people living with HIV … while reducing unnecessary burdens on the health system" [2]. C-BART is a differentiated care model in that (stable) patients are provided with antiretroviral therapy refills and clinical examinations outside of the health facility setting.

Down-referral: The process whereby patients are invited to attend C-BART sites. Patients are "down-referred" after antiretroviral therapy initiation and, in some cases, after the patient has been observed on antiretroviral therapy for a suitable period of time.

Lost to follow-up: Patients are considered lost to follow-up (LTFU) if they are absent from the facility for more than 90 days after their last scheduled follow-up date and there is no documentation of death or transfer out.

Retained (alive and on ART): According to the national guidelines, ART patients are considered LTFU if they interrupt treatment for 90 consecutive days or more [3]. Patients are considered "alive and on ART," or "retained" in care, if they have attended the health facility or C-BART site for any reason within 90 days after the scheduled appointment date and have not subsequently been documented as LTFU or as having died, stopped ART, or transferred out of the facility.

Treatment adherence: For this evaluation, treatment adherence is defined as taking antiretroviral therapy medicines exactly as prescribed. To measure adherence, the evaluation uses the patient pharmacy visit adherence score, defined as the average of medicine adherence scores (across multiple antiretroviral medicines) during the patient's pharmacy visits. The adherence score for a single medicine is calculated as follows:

$$\frac{\text{(Previous pill count + Quantity dispensed at last visit) – Current pill count}}{\text{Pills per day prescribed} \times \text{Days since last visit}}$$

For example, $((2 + 60) – 16) / (2 \times 23) = 100\%$.

Up-referral: The process whereby C-BART patients are referred back from the C-BART site to receive services and obtain ART refills at the hospital, health center, or clinic. Up-referral may occur due to poor adherence, treatment failure, or the presence of symptoms of other conditions, such as tuberculosis.

Viral suppression: Having a viral load test with < 1,000 copies per ml.

EXECUTIVE SUMMARY

INTRODUCTION

Despite some success in mitigating the epidemic, HIV remains the leading cause of death in Namibia. In 2017, HIV prevalence was estimated to be 12.1% among adults ages 15–49 years, and approximately 7,400 people became newly diagnosed with HIV. In 2007, a community-based antiretroviral therapy (C-BART) service delivery program was established in Okongo District and later expanded to Eenhana District. The establishment of the C-BART program was guided by evidence, methods, and tools generated by similar C-BART programs. It sought to address the obstacles of challenging terrain and distance that prevented many people from accessing appropriate HIV care.

In 2017, the Namibia Ministry of Health and Social Services (MoHSS), the U.S. Centers for Disease Control and Prevention (CDC), and the Elizabeth Glaser Pediatric AIDS Foundation (EGPAF) conducted an evaluation of the innovative C-BART program. The goals of the evaluation were to describe the implementation process of the C-BART program in Okongo and Eenhana Districts during the period January 2007—July 2017; to evaluate the outcomes of the program as measured by retention, adherence, viral suppression, and deaths; and to assess the program's acceptability to patients and health workers as well as its challenges and costs.

METHODOLOGY

The mixed-methods evaluation included quantitative, qualitative, and costing components. Quantitative data were collected to assess characteristics and clinical outcomes of antiretroviral therapy (ART) patients who received follow-up HIV care and ART refills at a C-BART site. Qualitative methods were used to assess the acceptability of the C-BART program to patients and health care workers (HCWs) and to describe the implementation process of the C-BART model over time. A costing component was conducted to assess the resources expended to implement the C-BART model and to inform future scale-up.

QUANTITATIVE COMPONENT

The study populations included 1,477 HIV-infected patients on ART who received services from January 1, 2007, to July 31, 2017, at the 34 C-BART sites in Okongo and Eenhana Districts. The study used data about patients' clinical encounters, pharmacy records, and viral load (VL) results routinely collected through the electronic patient monitoring system, electronic dispensing tool database, and MEDITECH® laboratory information system, respectively. Results describe C-BART patient demographic and clinical characteristics using frequencies and percentages for categorical variables, and medians and interquartile ranges (IQRs) for continuous variables. They also estimate proportions of patients retained in care and adherent to treatment at 3, 6, 12, 24, 36, 48, and 60 months, and report the proportion of patients virally suppressed (VL < 1,000 copies/ml) at these intervals as measured by their most recent VL test results.

QUALITATIVE COMPONENT

Qualitative data were collected through 11 in-depth individual interviews (IDIs) with policymakers and program managers, 5 focus group discussions (FGDs) with HCWs, 7 IDIs with health extension workers (HEWs), and 40 patient IDIs. Information was collected to describe the process of implementing the C-BART program, including the history of the program. Patients' and HCWs' response data on the acceptability of and challenges with the C-BART program were summarized through descriptive, text-based summaries and data display matrices to identify recurrent patterns and themes on patient satisfaction, service access, and recommendations for improvement.

COSTING COMPONENT

The costing component calculated the resources expended on the program by estimating the costs of relevant inputs.

RESULTS

QUANTITATIVE

After exclusion of 446 patient records due to record errors or missing information, 1,031 records (for 909 adults and 122 children) were included in the quantitative analysis.

Adult demographic and clinical characteristics: Over 50% (*n* = 504) of adult patients were from Okongo District. Of the 405 Eenhana patients, 21% were down-referred directly from the hospital, while 79% were first referred from the hospital to nurse-initiated and -managed antiretroviral therapy (NIMART) sites, and then down-referred from NIMART sites to C-BART sites. Among C-BART patients overall, 64% (*n* = 586) were female, and 60% (*n* = 494) were single, separated, or widowed. The median age at ART initiation was 38 years (IQR: 32−46), with 38% of patients (*n* = 344) having been initiated on ART at ages 35–44 years. Over 46% (*n* = 422) of patients initiated ART in the period 2011–2014, and 90% (*n* = 802) were assessed to be in World Health Organization (WHO) clinical stage 1 or 2 of the disease at the time of initiation. However, 48% (*n* = 413) of patients had a CD4 count of ≤ 200 cells/µL at ART initiation. Over 85% (*n* = 778) of adult patients at C-BART were on ART for at least a year before they were down-referred. The remaining 14% were down-referred within a year after starting ART. The median time that patients were on ART prior to down-referral was 45 months (IQR: 20−74), with Okongo patients down-referred earlier, after a median of 31 months (IQR: 14−57), compared with 71 months (IQR: 45−92) for Eenhana C-BART patients and 63 months (IQR: 36−93) for Eenhana NIMART/C-BART patients. Patients were in C-BART for a median of 17 months (IQR: 9-32), with Okongo patients having a longer median time of 28 months (IQR: 10-61) in C-BART.

Adult retention in care: In Okongo District, 91% (*n* = 141) of patients were still in care at 60 months from the time they were down-referred to C-BART. Across both districts, 99% (*n* = 522) of patients were retained in care at 12 months, including 100% (*n* = 158) of C-BART and NIMART/C-BART patients in Eenhana District, the maximum period of observation for these sites.

Adult ART adherence: Adherence data were available for 345 adults (38%). Over 80% of Okongo patients achieved good adherence, defined by a score of ≥ 75%, as per Namibia standards. Adherence data were available for only 3 Eenhana patients, too few to analyze.

Adult viral suppression: Overall, 98% (*n* = 800) of the 817 patients alive and on ART with available VL results were virally suppressed, and 98% (*n* = 532) were virally suppressed at least 4 months after down-referral, with no significant difference between districts.

Pediatric demographic and clinical characteristics: About half of the 122 children (51%, *n* = 62) were from Okongo District, and overall, 56% (*n* = 68) were male. About half of the children (51%, *n* = 62) initiated ART at ages 5–14 years, and 28% (*n* = 34) initiated ART at < 2 years of age. About half of the children (51%, *n* = 62) initiated ART between 2007 and 2010, while 42% (*n* = 51), initiated ART from 2011 to 2014. Most children were in WHO clinical stage 1 or 2 at ART initiation (80%, *n* = 95), though 53% (*n* = 50) were assessed to have advanced or severe HIV immunodeficiency by CD4 count or percentage at ART initiation.

Pediatric retention in care: The retention in care among children for whom this information was available (*n* = 28, all from Okongo District) was similar to that of the adults, with 96% being retained in care at 60 months.

Pediatric ART adherence: Among the 44 children for whom these data were available (all from Okongo), only 64% had adherence scores of ≥ 75%.

Pediatric viral suppression: Of the 108 pediatric patients alive and on ART with available VL results, 94 (87%) were virally suppressed. Of the 108 children, 75 (69%) had an available VL result from at least 4 months after their down-referral, and viral suppression was similarly high (87%) among these patients.

Descriptive characteristics of C-BART patient deaths: There were 23 deaths recorded during the period reviewed. The mean age of the deceased patients was 44 years; 57% (*n* = 13) were male, and 62% (*n* = 13/21) were single. The majority of deaths occurred from 2014 to 2016 (*n* = 18), and the median time from ART initiation until down-referral was 15 (IQR: 12–27) months. The median time patients were in C-BART was 24 (IQR: 16–44) months. The median time from the last VL test to death was 8 months (IQR: 1–13), and the median CD4 count was 129 cells/μL (IQR: 87–248) at the start of ART, though only 3 patients were assessed to be in WHO clinical stage 3 at ART initiation.

QUALITATIVE

Findings from the IDIs and FGDs confirmed that the idea of providing treatment nearer to patients' residences came from nurses at Okongo District Hospital in 2006–2007. Nurses had observed patients arriving in groups due to shared transportation, which overcrowded the facility. Over time, the idea of C-BART gained acceptance among both the patients/community and the HCWs, due to reduced patient/community costs and reduced health worker workload. In addition, the shorter waiting times increased patients' time for income-generating activities. The introduction of HEWs was important in following up patients who missed C-BART visits and in linking HCWs and the community. Challenges to the program, however, were lack of privacy, lack of infrastructure, inconsistent arrival times of the HCWs, lack of standard operating procedures, lack of monitoring and evaluation systems, and minimal training for HEWs and nurses.

COSTING

The costing analysis found that the total estimated program expenditure on C-BART was 93,736 U.S. dollars (USD), with the Okongo cost being 40,980 USD and the Eenhana cost 52,756 USD. The cost per site was 2,561 USD for Okongo and 2,931 USD for Eenhana. The cost per patient per year was 58.54 USD in Okongo and 68.78 USD in Eenhana. At 61%, labor constituted the largest cost component, followed by clinical site/supplies at 25%, capital costs at 11%, and travel/transportation at 3%.

DISCUSSION

The C-BART program appears to have been successful in its goals of ensuring program retention, ART adherence, and viral suppression. Retention was higher than the national retention indicators of 88.5% at 12 months and 70.2% at 60 months. C-BART patient viral suppression was also higher than the national rate of 77% as well as the Ohangwena region's 86% viral suppression rate. C-BART retention was comparable to that reported by other community ART programs, including community adherence groups in other African countries. ART adherence among C-BART patients was also higher than the national estimate of 62% of ART patients, with a C-BART adherence score of ≥ 75%.

Retention, adherence, and viral suppression were similar for the Okongo and Eenhana sites, despite the fact that compared with Okongo's, the Eenhana C-BART program more systematically applied the criterion that only patients who had been stable on ART for six months could be down-referred into the program. This result brings into question the need for a six-month stability criterion for down-referral to C-BART.

The mortality analysis highlighted that 20 of the 23 C-BART patients who died had a clinical visit within 3 months of their death, a fact that needs to be explored further. These patients may have been failing treatment, yet all were

still on first-line therapy. This result has implications for strengthening the quality of ART care in the C-BART program. Also, the majority of patients were men, and many of them had initiated ART at older ages, suggesting that more efforts are needed to get men onto ART earlier.

Though the retention of children was comparable to that of adults in the C-BART program, adherence and viral suppression were markedly lower. Due to limitations in assessing adherence, it might be that patients' true adherence is higher than that represented, and more so for children than for adults. Nevertheless, adherence and viral suppression, taken together, are still lower for children than for adults, indicating a need for closer adherence support and VL monitoring for children in C-BART care.

The qualitative findings suggest that the C-BART program is well accepted and supported by patients, the community, HCWs, program managers, and policymakers. The program has responded to a need in a rural, sparsely populated region of Namibia, and in doing so, has engaged communities, community leaders, and patients in such a way that they have become partners with the HCWs and the program managers in supporting patients on ART, with potential positive outcomes for all of the stakeholders. Additionally, the program provides a platform to potentially integrate primary health care with comprehensive HIV care. However, the lack of privacy and limited infrastructure at the C-BART sites, the lack of standard procedures, inadequate patient tracking and evaluation systems, insufficient training of HEWs and nurses, and inconsistent arrival times of the C-BART team have limiting effects on the program. These effects could be mitigated by increasing the formalization of the program, improving its systems, and finding resources to improve its infrastructure and facilitate privacy.

The total costs to implement the C-BART program in Okongo and Eenhana Districts, as well as the estimated annual per-patient costs, seem reasonable when considering the reduced burden at the health facility and reduced costs to patients in the form of lower transportation costs and less wait/travel time, and given the limited number of benchmarks available in the literature. It may be useful also to estimate the annual per-patient cost of the ART clinics to compare with C-BART costs. These costing data may facilitate policymakers' budgeting and planning for resourcing the response to the HIV epidemic, including the potential scale-up of a C-BART model across Namibia.

One limitation of this evaluation was reliance on data abstracted from patient health records, which may have quality concerns such as missing data and data entry errors. Linking patients across the three database systems was a particular challenge, most notably in MEDITECH, which did not have a field for the commonly used unique patient identification number. Limitations and challenges with the qualitative analysis (of the IDIs and FGDs) include the potential for response bias (the respondents may report what the interviewer would like to hear), differential nonresponse (participants who refuse to be interviewed may be different from those who agree to the interview), and recall bias (participants may selectively recall stakeholders and events). Experienced interviewers and FGD facilitators were carefully selected and trained to mitigate these potential biases. A challenge in capturing the costs of and resources needed for the C-BART program was the availability and quality of the necessary documentation. In addition, the retrospective estimation of the time program staff spent on C-BART activities may not be as accurate as if these data had been captured prospectively. However, we worked closely with MoHSS staff to identify the necessary documents and to triangulate the data to assure validity.

CONCLUSION AND RECOMMENDATIONS

Overall, C-BART is a well-accepted program that, in partnership with the community, has been effective in improving patient retention, ART adherence, and viral suppression. Its costs appear to be reasonable, and cost savings may have been realized through both a reduced patient burden on the health facility and a reduced cost burden on patients. We offer the following recommendations:

1. Reassess the criterion of six months of stability on ART for down-referral. Evaluation results indicate that this period could be shortened or the requirement eliminated with limited negative effects on patient clinical outcomes.

2. Review global evidence on pediatric ART adherence and triangulate this with routine data on pediatric C-BART patients. Examine program, facility, and patient factors that affect adherence; provide targeted HCW training; and review how pediatric patients are managed and how often visits should occur among the different age groups, in order to explore how pediatric ART adherence could be improved in C-BART.

3. Further analyze factors associated with C-BART patient deaths, including cause of death. In particular, examine the reasons why the majority of recorded deaths were of patients who had had clinic visits within three months of death, as well as the reasons for more deaths of males than females. This examination should include a review of the processes for identifying patients who may be failing ART and transitioning them to second- or third-line regimens. Also, explore whether targeted efforts to encourage men to initiate ART earlier may be needed.

4. Consider formalizing the C-BART program through (1) developing a manual of operations and standard operating procedures to standardize activities, (2) improving the patient tracking and down- and up-referral systems, and (3) developing a specific C-BART training program for HCWs and HEWs. The formalization of the program could also include integration of comprehensive HIV and primary health care services.

5. Consider conducting a study to estimate the annual per capita costs of facility-based ART care. This information could then be compared with C-BART costs to inform planning and potential scale-up of the C-BART program.

6. Consider expanding the C-BART program to similar rural settings in Namibia.

7. Continue to develop unique patient identifiers to ensure that each patient has one unique identity within the health system, and consider introducing one electronic medical record system to be used at all points of care. This strategy would facilitate the development of longitudinal medical records and allow users of services to be tracked across the health care sector. Ensure that National Institute of Pathology requisition forms capture the patient's unique ART number for upload into the MEDITECH system.

8. Mobilize resources to enable privacy at the C-BART sites.

This traditional C-BART structure, and the open waiting area behind it, did not offer clients much privacy – or protection from the elements.

1. C-BART EVALUATION

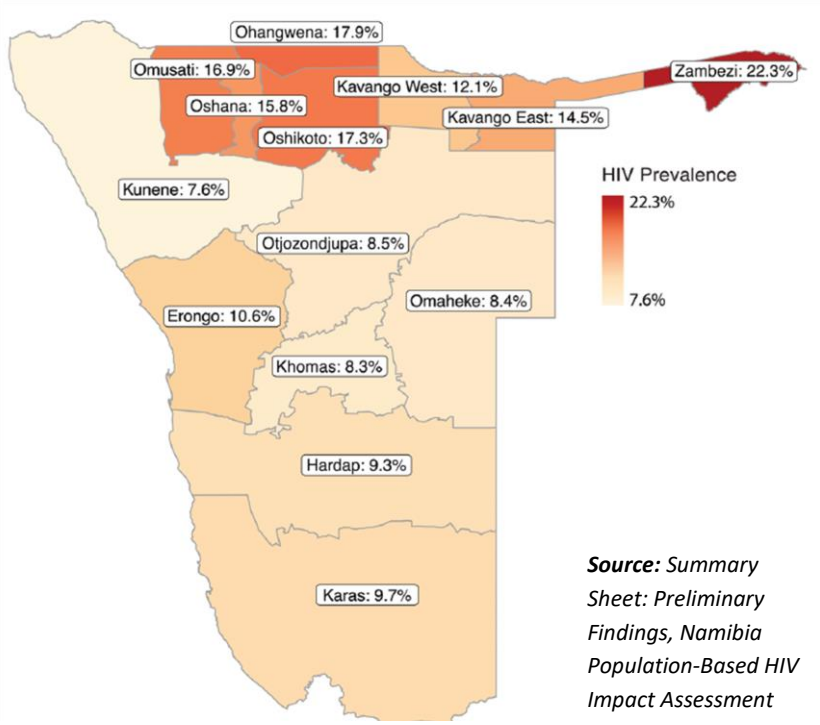
1.1 INTRODUCTION

THE HIV EPIDEMIC IN NAMIBIA

Despite success in mitigating the HIV epidemic, HIV prevalence in Namibia was still estimated to be 12.1% among adults 15–49 years old in 2017 [4]. Approximately 200,000 people are now living with HIV in Namibia. HIV remains the leading cause of death, with an estimated 2,700 AIDS-related deaths in 2017. Although HIV incidence is declining, an estimated 7,400 people were newly infected with HIV in 2017.

Namibia is one of the most sparsely populated countries in the world, and its unique geography contributes to the difficulty of detecting HIV-positive individuals, getting them on antiretroviral treatment (ART), and facilitating ART adherence. As shown in Figure 1, HIV prevalence is greatest in the northern regions of Zambezi (22.3%), Oshikoto (17.3%), Omusati (16.9%), Oshana (15.8%), and Kavango East (14.5%), which are also the most densely populated regions [1]. However, prevalence is also relatively high in the more sparsely populated southern regions, where access to health care is more limited.

FIGURE 1. HIV PREVALENCE BY REGION IN NAMIBIA, 2017



Source: *Summary Sheet: Preliminary Findings, Namibia Population-Based HIV Impact Assessment*

Similar to other sub-Saharan African countries, women are disproportionately affected by HIV in Namibia. Among adults (ages 15–49 years), HIV prevalence is estimated to be 14.5% among women and 9.5% among men [4]. Youth are also disproportionately affected, with approximately one-third of new infections occurring in the 15- to 24-year-old age group.

ANTIRETROVIRAL THERAPY IN NAMIBIA

The government of the Republic of Namibia adopted the World Health Organization (WHO) test-and-treat strategy (called "treat all" in Namibia), with new guidelines launched in December 2016. Namibia began transitioning to Option B+ (lifelong ART for pregnant women) for prevention of mother-to-child HIV transmission in the second quarter of 2014.

The National HIV Care and Treatment Program has achieved relatively high ART coverage. An estimated 84% of all people living with HIV (PLHIV), including 85% of adults and 76% of children, were on ART in 2017 [4]. UNAIDS (the Joint United Nations Programme on HIV/AIDS) estimated in 2017 that 12-month retention on ART was 84% among adults and 79% among children, and that 74% of PLHIV were virally suppressed. Data from the Namibia Institute of Pathology (NIP), however, indicates that viral suppression (defined as a viral load, or VL, of < 1,000 copies/mL of blood) in 2016 was 89% among adults and 77% among children [4, 5].

The majority of HIV-positive patients in Namibia receive care and treatment from 313 of the country's 326 public health facilities, but some faith-based facilities and private clinics also provide ART. ART initiation and drug refills occur at hospitals, at health centers, and at clinics that have nurse-initiated and -managed antiretroviral treatment (NIMART) nurses.

COMMUNITY-BASED ART MODELS

Decentralization of HIV services is a trend across sub-Saharan Africa due to overburdened health systems and increasing numbers of patients on ART. Many ART programs note increasing numbers of patients lost to follow-up (LTFU) with the rapid scale-up of ART. Recognizing that PLHIV have diverse needs as to type, location, provider, and frequency of HIV care services, the WHO recommends the establishment of differentiated models of care, such as community-based ART, to address the needs of stable patients [6]. Community-based ART models exhibit the concept of "down-referral," which decentralizes care by referring stable patients on ART from high-level to low-level care facilities embedded within rural communities.

Community-based ART models in the Democratic Republic of the Congo (DRC), South Africa, and Uganda have demonstrated the benefits of decentralized ART distribution. In the DRC, community ART distribution points demonstrated significant improvements in patient retention, waiting time, and overall cost [7]. Average 12-month patient retention was more than 10% higher and waiting time was, on average, 70 minutes shorter than in the standard model of care. In Cape Town, South Africa, community-based adherence clubs increased patient retention and reduced the time to viral suppression (VL < 1,000 copies/mL) [8]. In this model, HIV-positive club members collected prepackaged ART at a facility and redistributed the packets to all club members at a more convenient community location. In Jinja, Uganda, the Community Drug Distribution Point model mitigated time and financial constraints, and achieved a VL suppression rate of 93% by using lay counselors and stable patients to support ART distribution at the community level [9].

From the health systems perspective, community-based ART models reduce staff workload, give clinical staff more time to focus on clinical issues, improve the quality of care, improve patient self-management, and result in fewer missed appointments. From the patient perspective, the models reduce financial costs related to treatment and/or travel, reduce waiting time at facilities, require fewer facility visits, and increase peer support and community participation [7, 10]. Yet successful implementation of community-based ART services relies on a sufficient supply of ART drugs, task shifting to lay cadres, inclusion of community members, patient access to quality clinical management when referred, stakeholder involvement, routine monitoring of VL and adherence, and monitoring and evaluation (M&E) of the program [11].

THE C-BART PROGRAM IN NAMIBIA

In 2007, Namibia's Ministry of Health and Social Services (MoHSS), with support from the U.S. Centers for Disease Control and Prevention (CDC), established a community-based ART (C-BART) service delivery program in Okongo District; it expanded the program to Eenhana District in 2016. Both districts are located in the Ohangwena Region of northern Namibia. The establishment of C-BART was guided by evidence, methods, and tools generated from similar community-based ART programs. It sought to address the obstacles of challenging terrain and distance that prevent many PLHIV from accessing appropriate HIV care. C-BART services entail four or five visits a year by a district health team that refills ART prescriptions; provides HIV testing and counseling, clinical evaluations, and adherence counseling; and collects blood specimens for VL and CD4 analysis. Patients who miss appointments are followed up in their communities by volunteers or community health workers, called health extension workers (HEWs). The MoHSS requires that patients be on treatment for at least six months before receiving down-referral from a high-level facility to a C-BART site. Proximity and patient willingness to receive care at a community outreach point are additional criteria for down-referral of HIV-positive patients to C-BART sites.

As of December 2017, there were 16 C-BART sites in Okongo District and 18 sites in Eenhana District. Although patients are not currently initiated on ART at C-BART sites, the Eenhana District team plans to implement ART initiation at its C-BART sites in the future. Patients who require urgent medical attention between C-BART visits are encouraged to visit the nearest health clinic.

As the MoHSS implements the "treat all" strategy to achieve universal HIV treatment coverage, innovative models for service delivery are needed to scale up ART across the country while maintaining or improving the quality of ART programs. This evaluation of the C-BART program was designed to provide the MoHSS and its partners with valuable information to guide program expansion, improvement, and integration into a comprehensive set of ART service delivery strategies as Namibia moves to control the HIV epidemic by 2020. This report presents the key findings of the evaluation of the C-BART program in Okongo and Eenhana Districts of Namibia.

1.2 EVALUATION GOAL, OBJECTIVES, AND KEY QUESTIONS

GOAL

To describe the implementation process of the C-BART program in Okongo and Eenhana Districts, Namibia, during the period January 2007–July 2017; to evaluate outcomes of the program; and to assess the program's acceptability to patients and health workers as well as its challenges.

OBJECTIVES

1. To characterize patients on ART in the C-BART program in Okongo and Eenhana Districts
2. To evaluate outcomes (retention, treatment adherence, loss to follow up, viral suppression, deaths) of the patients on ART in the C-BART program in Okongo and Eenhana Districts
3. To describe the process of implementation of the C-BART program, including the resources needed
4. To assess the program's acceptability to patients and health care providers, and the challenges to implementing it

KEY QUESTIONS

- What are the outcomes (retention, loss to follow up, adherence, viral suppression, death) at 3, 6, 12, 24, 48, 36 and 48 months among patients referred to the C-BART sites for continuity of care?

- What proportion of patients who receive follow-up care at a C-BART site achieve viral suppression after 6 and 12 months of treatment, respectively, and sustain suppression over time?
- What is the level of ART adherence among patients in the C-BART program?
- What are the implementation processes, and what resources are needed to implement the C-BART program in Okongo and Eenhana Districts?
- How acceptable is the C-BART program to health care workers (HCWs) and patients, and what are the challenges with implementing the program?

1.3 STUDY DESIGN

OVERVIEW

A study team was formed to plan and implement this evaluation. The evaluation was designed by the MoHSS in partnership and collaboration with the CDC and the Elizabeth Glaser Pediatric AIDS Foundation (EGPAF). The study team (listed in Appendix 1) contributed to the development of the protocol and oversaw the implementation.

This evaluation uses both quantitative and qualitative methods. Quantitative data were collected to assess characteristics and clinical outcomes of ART patients who received follow-up HIV care and ART at a C-BART site. The qualitative component assessed the acceptability of the C-BART program to patients and HCWs, and described the implementation process. A costing study was also conducted to assess the resources necessary to implement the program.

EVALUATION SETTING AND LOCATIONS

The evaluation was carried out in Okongo and Eenhana Districts in the Ohangwena Region of northern Namibia, where C-BART services have been taking place. The health facilities and C-BART sites that participated in the evaluation are listed in Appendix 2, and a map of C-BART sites in shown in Appendix 3.

This counseling bench is easily visible from both the C-BART structure, and the nearby waiting area.

2. QUANTITATIVE EVALUATION

2.1 METHODOLOGY

STUDY POPULATION

For the quantitative component, the analysis included all HIV-infected patients (of any age) on ART in Okongo and Eenhana Districts who were down-referred to a C-BART site for follow-up HIV care from January 1, 2007, to July 31, 2017.

DATA SOURCES

Three primary data sources were utilized in this evaluation: the electronic patient monitoring system (ePMS) database, which we obtained from the Response Monitoring and Evaluation Division of the MoHSS; the electronic dispensing tool (EDT) database, obtained from the Pharmaceutical Services Division of the MoHSS; and the laboratory information system (MEDITECH®) database, obtained from the NIP. Other data sources were used to locate missing data or improve data quality, including patient care booklets (PCBs), which are housed at the health facility; "health passport" booklets kept by patients; and district pharmacy records. Tracking data across the ePMS, EDT, and MEDITECH systems was challenging due to lack of a common unique identifier to link data across these stand-alone systems (i.e., ePMS for facility visits, EDT for pharmacy pickups, and MEDITECH for laboratory results). Thus, multiple data sources were used to generate complete laboratory and adherence-related patient information.

EPMS

The ePMS data system, established in 2003, contains longitudinal electronic medical records for all HIV-positive patients enrolled into care at public health facilities throughout Namibia. Health facility–based data clerks enter data from the PCB into the ePMS at each patient visit. The PCBs capture data including demographic data, clinical data for each clinic visit, and laboratory test results, including VL test results. Every quarter, each district sends all ePMS data from each facility to the national-level MoHSS to be merged into the central database for reporting. The system has the capacity to generate various reports and patient lists, such as a list of patients who have been LTFU, as well as standard monthly, biannual, and annual reports on the numbers of patients enrolled into care, categorized as medically eligible, initiated on ART, alive and on ART, and on specific treatment regimens, as well as cohort analysis reports.

The ePMS system designates patients down-referred to C-BART by site-specific codes, which were assigned starting in April 2016. C-BART site-specific codes were added in the ePMS retrospectively (as part of this evaluation) for patients down-referred between 2007 and 2016. In preparation for the outreach visits, staff at the main district health facility generate from the ePMS a list of patients expected at a particular C-BART site on a particular day. All patients in care at a particular site are seen as a cohort on the same day, so they all have the same follow-up appointments as well. Prior to each visit, using the generated ePMS list, the PCBs of expected patients are pulled at the health facilities, and the outreach teams take them to the C-BART sites. Patients' records at C-BART sites are entered on the standard paper-based PCBs and then transferred into the ePMS by data entry clerks based at the district health facility.

EDT: ANTIRETROVIRAL DRUG DISPENSING RECORDS

The EDT was first implemented in public ART facilities in 2005, for monitoring the performance of ART pharmaceutical services and for providing up-to-date data for planning and decision-making purposes. Data from

each patient pill pickup are entered by pharmacists from the patient health passport, which contains information on date of ART initiation, ART regimens, dosage, and dispensing dates, including measures of ART adherence at the time of dispensing. Similar to the ePMS, EDT data are transmitted to the MoHSS quarterly to enable merging into a central database. Current challenges with the EDT include delayed data capture from NIMART and C-BART sites, and incomplete patient ART number recording. The EDT is largely implemented at the main district ART facilities, where a pharmacist is responsible for capturing the data. A scaled-down version of the EDT, called EDT Mobile, is used at other facilities and, to some extent, at C-BART sites, but devices are limited in number due to cost. EDT Mobile has limited capabilities to update dispensing information for existing patients already registered in the EDT and to sync with the main EDT; moreover, it does not have the ability to register new patients. In November 2015, another version, called EDT Light, was introduced; it can be used to capture dispensing data at smaller facilities, including C-BART sites, and also has the ability to register new patients. Data captured through EDT Light is uploaded into the main EDT database after C-BART visits.

MEDITECH: LABORATORY RESULT RECORDS

MEDITECH is a national laboratory information system that the NIP has used for laboratory data management since 2004. Health facility clinicians order tests by completing a standardized paper-based NIP requisition form, which indicates all requested laboratory diagnostics to be performed. Patient specimens are then collected and sent to the district-level NIP laboratory with the form. Key variables on the NIP requisition form are entered into the MEDITECH system by the laboratory-based data entry team, including patient demographic data such as given name and surname, sex, date of birth, patient unique ART number, and information on relevant clinical and medication data (including type of laboratory test requested, e.g., VL, CD4). However, although the NIP laboratory requisition form can capture the patient's unique ART number, this section is not always completed on the form, and was not present in the MEDITECH data included in this evaluation.

After diagnostics are performed (at either the district NIP laboratory or the NIP national reference laboratory), the results are linked to the patient record when they become available. Data from MEDITECH are routinely uploaded into the NIP Laboratory Data Repository, which was designed to facilitate routine monitoring and analysis of data captured in MEDITECH.

The MEDITECH system enables results to be accessed through various platforms (text messages, MEDITECH terminals, web portals) at any of the laboratories as soon as the results have been certified by the laboratory that conducted the test. Thus, data are available in real time at district labs throughout the country. At the district hospitals and a few of the larger facilities where NIP laboratories are located, results are obtained from the MEDITECH terminals. At other facilities, laboratory results are obtained through text message, auto-generated by MEDITECH, or accessed through an online web portal system. Regardless of the platform, a paper printout of laboratory test results is sent to the requesting facilities through the district laboratories. The results are then recorded and filed in the individual PCBs by clinicians. Data clerks then capture the laboratory results from the PCBs and enter them into ePMS.

QUANTITATIVE DATA COLLECTION

CONSTRUCTION OF EPMS-EDT-MEDITECH COMPOSITE DATABASE

For this evaluation, we extracted data from the ePMS as of November 30, 2017, to allow at for least four months of follow-up time in C-BART. We used the C-BART outreach codes to identify all patients on ART in Okongo and Eenhana Districts who had been down-referred to C-BART from January 1, 2007, through July 31, 2017.

We obtained the ePMS data for each district from the Response Monitoring and Evaluation Division of the MoHSS and extracted data including patient demographic and clinical characteristics at ART initiation, actual and scheduled clinic visits, and information on patient deaths. We obtained the EDT database from the Pharmaceutical Services Division of the MoHSS and extracted data including patient adherence scores for medications dispensed at pharmacy visits. We obtained the MEDITECH database from the NIP and extracted data on VL tests and so on. Finally, we created a composite database by merging data from these three different sources of routinely collected data.

Of the 1,504 records in the ePMS database, we identified 35 patients with duplicate unique ART numbers because they had visited more than one facility. These duplicate records were retained for further investigation and included in the data used to link to EDT and MEDITECH at the facility level. Data were collected from EDT records of C-BART patients in Okongo and Eenhana Districts from January 1, 2007, to July 31, 2017. The EDT database contained no duplicates. Data clerks at each district updated the ePMS database to ensure that a C-BART code was recorded in the ePMS database for each C-BART patient. Data clerks then updated the ePMS database with the EDT number to allow for linking it with the EDT database. Using the PCBs, the data clerks also updated the status of all ART patients in the ePMS database who were LTFU, died, or had transferred out of C-BART sites. All of these steps were performed prior to data abstraction. Data were collected from the MEDITECH records for C-BART patients, including VL test results from the time they were first recorded in 2014 through November 2017.

After the removal of the duplicate ART numbers, we obtained a sample of 1,467 C-BART patients. We linked the ePMS patient data with EDT records using the following linking variables: unique ART number, last name, first name, gender, date of birth (DOB), and date of ART initiation. Because the MEDITECH database did not contain the unique ART number, we had to rely on the last name, first name, gender, and DOB variables to link the ePMS and MEDITECH records.

We subsequently attempted to validate the ePMS-EDT matches and the ePMS-MEDITECH matches. A true ePMS-EDT match was defined as agreement between the EDT number from the PCB and the EDT number in the study database. Similarly, a true ePMS-MEDITECH match was defined as agreement between the last VL date/result from the PCB and a VL date/result in the study database. We had previously randomly selected 90 patients from the data set and located their PCBs for comparison with the study data set.

Overall, the ePMS-EDT match was 64% (48/75), with 90% (37/41) in Okongo, but only 32% (11/34) for Eenhana, with NIMART/C-BART[1] patients in Eenhana having an especially low percentage of matches (9%). The ePMS-MEDITECH match was 50% (25/50) overall, 58% (14/21) for Okongo, and 28% (11/39) for Eenhana. Because these match rates were unacceptably low, potentially biasing the results of the patient outcome analyses, we carried out a data verification exercise in September 2018 in which the EDT number, the VL date/result, and the date of down-referral were updated/abstracted for all C-BART patients in the study data set. For each patient, we updated/abstracted the pharmacy number from the EDT and entered it into the ePMS at the Okongo and Eenhana sites. We abstracted the most recent VL test result from patients' health passports at routine and specially rescheduled C-BART visits. We searched the PCBs, ePMS, and then MEDITECH only when we could not obtain the latest VLs from patients' health passports. We also abstracted the date of down-referral from the PCBs or patient health passports, and attempted to find any instances of up-referral for patients who may have needed care at the referring health facility for any reason. Further details on the linkage of the data, deduplication of records, and data quality and verification are in Appendix 4.

[1] In Eenhana District, many patients are first referred to NIMART sites and then, if stable, down-referred to C-BART sites in their catchment areas. These patients are referred to as NIMART/C-BART patients.

We identified 10 additional C-BART patients from Eenhana District during the data verification exercise, who were subsequently added to the study database. These additions gave us a total of 1,477 C-BART patients in the final study database. We did not find documentation of any up-referrals.

2.2 DATA ANALYSIS

We used descriptive statistics, in the form of proportions/percentages, medians, and interquartile ranges (IQRs—that is, the range from 25th to 75th percentile), as appropriate, to describe patient characteristics by district C-BART program. Then we analyzed patient outcomes, including retention in care, ART adherence, viral suppression, loss to follow-up, and mortality, as of the end of the study period—that is, the date when we extracted the data from the ePMS database (November 30, 2017). We stratified all of these analyses by district. In Eenhana District, we further stratified patients by whether they were down-referred from the ART clinic at the Eenhana District Hospital to a C-BART site (patients who followed this pathway were called Eenhana C-BART patients), or first down-referred to a NIMART site and then, during the study period, down-referred to a C-BART site (classified as Eenhana NIMART/C-BART patients). In addition, we analyzed pediatric and adult patient outcomes separately because the pediatric data added valuable information to the scant evidence on the effectiveness of community-based ART delivery models for children [6].

PATIENT CHARACTERISTICS

We collected from the ePMS the following demographic and clinical characteristics of patients: C-BART site, sex, age at ART initiation (years), marital status (for adults, i.e., patients ages 15 and older), year of ART initiation, WHO clinical stage at ART initiation, CD4 count (cells/μL) at ART initiation (for adults), classification of HIV-associated immunodeficiency at ART initiation (for children), duration on ART from ART start to the date of a documented clinical outcome (i.e., the end of the study period if the patient was known to be alive and on ART at that time, or the date the patient died, became LTFU, stopped ART, or transferred out of the health district), duration on ART from ART start to down-referral, and duration in C-BART from down-referral to the date of an outcome event (as defined above).

RETENTION IN CARE

We measured cohort retention in ART care for cohorts of C-BART patients who were down-referred to a C-BART site and followed longitudinally from their date of down-referral until November 30, 2017. We categorized patients into cohorts based on retention in care, defined as the number of months a patient was in care from the date of down-referral to a C-BART site until the date of an outcome event (i.e., the end of the study period or the date of death, ART discontinuation, loss to follow-up, or transfer out of the health district). Cohorts were 3, 6, 12, 24, 36, 48, and 60 months (see Table 1). A C-BART patient was included in a given cohort if the time from down-referral to outcome event was as at least as long as the time defined by the cohort:

TABLE 1. RETENTION COHORT DEFINITIONS

Retention cohort	Number of days after down-referral
3-month	91 days
6-month	182 days
12-month	364 days
24-month	728 days

Retention cohort	Number of days after down-referral
36-month	1,092 days
48-month	1,456 days
60-month	1,820 days

For instance, a C-BART patient would be included in the 12-month retention cohort analysis only if that patient's duration of being alive and on ART from the date of down-referral to the end of the study period (November 30, 2017) was at least 12 months in length; this patient would also be included in the 3-month and 6-month cohorts. For each retention cohort, retention was defined as the number of patients alive and retained on ART at the C-BART site by the end of the retention cohort period, divided by the number of patients who were down-referred to C-BART and were expected to be alive and on ART at the site at the end of the retention cohort period (excluding those who transferred out, but including those who transferred in). According to the national guidelines, ART patients are considered lost to follow up (LTFU) if they interrupt care (e.g., miss an appointment or ART pickup) for 90 or more consecutive days after the scheduled appointment date [3]. Therefore, C-BART patients were considered alive and on ART (i.e., retained in care) if they attended the health facility or C-BART site for any reason within 90 days after a scheduled appointment date and had not subsequently been documented to have died, been LTFU, or stopped ART. Thus, 90 days were added to each duration on ART to reflect a grace period after the scheduled visit date before a patient could be considered LTFU or not retained.

ADHERENCE TO ART

Among all C-BART patients, we analyzed the average of adherence scores across all pharmacy visits that occurred during the 12 months prior to the ePMS data extraction date (November 30, 2017). A patient's pharmacy visit adherence score is an average of medicine adherence scores (across multiple antiretroviral medicines) calculated from information collected during the patient's pharmacy visit. In EDT, a patient's adherence score for an individual antiretroviral medicine uses pill counts and the dosage and number of days for which the medicine was prescribed to derive a medication adherence score. The individual medicine adherence score calculation is the following:

$$\frac{(\text{Previous pill count} + \text{Quantity dispensed}) - \text{Current pill count}}{\text{Pills per day prescribed} \times \text{Days since last visit}}$$

For example, $((2 + 60) - 16) / (2 \times 23) = 100\%$.

VIRAL SUPPRESSION

Among C-BART patients alive and retained in C-BART care as of the date of ePMS data extraction (November 30, 2017), we analyzed viral suppression using the most recent VL test result, irrespective of whether the VL test occurred before or after down-referral to C-BART. In a separate calculation, we also analyzed viral suppression by including only VL results that were completed at least three months after down-referral. As per the national guidelines, viral suppression was defined as ≤ 1,000 copies/ml [3].

MORTALITY

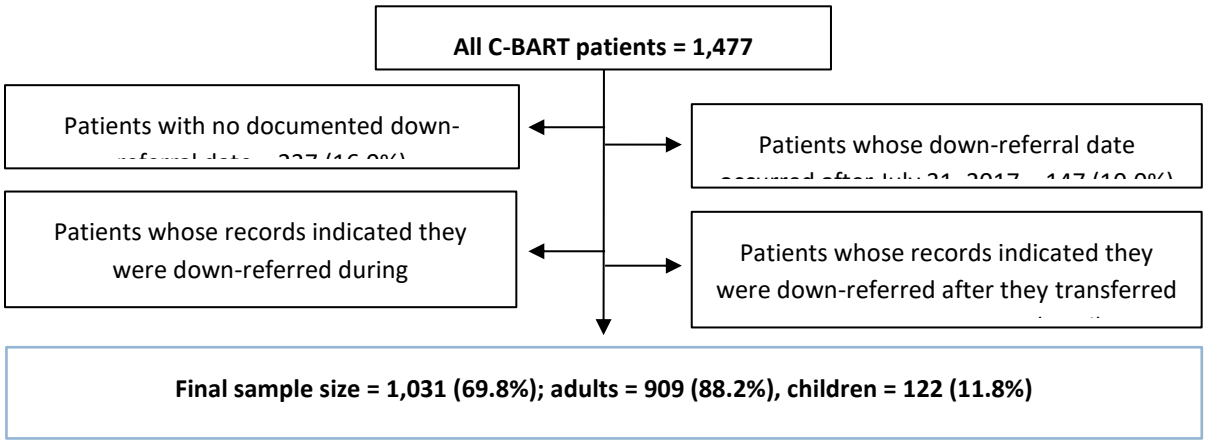
We captured and analyzed selected demographic characteristics of C-BART patients who died during the period covered by the study, including demographic and clinical data. Deaths and death dates are supposed to be captured

in ePMS, irrespective of where the deaths occurred, and may be reported to the clinics by family members, inpatient department nurses, or LTFU tracking officers, or documented after a home visit or a phone call to a treatment supporter. We searched for deaths in the ePMS files for the two districts and found 27 deaths in Okongo and no deaths in Eenhana during the study period. During our data validation visit to Eenhana and Okongo Districts in April 2018, we discovered that deaths were not always captured in ePMS, particularly in Eenhana District. Currently, all deaths, whether reported in the community or at the facility, are recorded at the district hospital, not at C-BART sites. We therefore requested that the district sites provide updated ePMS files for the sites, from which we extracted a list of all the people who had died from January 2016 through December 2017, regardless of cause. During this period, there were 53 deaths in Okongo and 149 deaths in Eenhana. We merged these files of all deaths in Okongo and Eenhana with the deaths recorded in our composite database by unique ART number. In this manner, we found 3 deaths of C-BART patients in Eenhana and 2 additional deaths in Okongo (making 29 in the latter district), for a total of 32 deaths in our C-BART cohort of 1,477 patients.

2.3 RESULTS

Of the total 1,477 C-BART patients, 446 patients were excluded from analysis either because they did not meet the inclusion criterion for the timing of down-referral or because their date of down-referral was missing (Figure 2). The final sample was 1,031 patients (909 adults and 122 children). All of these patients had ePMS data available for summarizing retention in care. Of the 1,031 patients, 1,015 (98.4%) had EDT numbers that we obtained from pharmacy records during the verification exercise, and 724 (70.2%) were ePMS-EDT matches; of the 724 matches, 522 (72.1%) had EDT numbers that we verified as correct using district pharmacy records. Of the 522 verified ePMS-EDT matches, 389 (74.5%) had available information on adherence.

FIGURE 2. SELECTION OF PATIENTS FOR THE EVALUATION



We could abstract the most recent VL test from a total of 1,002 (97.2%) patient records (for 884 adults and 118 children).

ADULT PATIENT CHARACTERISTICS

Overall, 909 adults were included in the analysis. More than half of these (55.4%, *n* = 504) were from Okongo District (Table 2). Overall, 64.5% (*n* = 586) of patients were female. Eenhana District (C-BART and NIMART/C-BART) had a greater proportion of female patients (72.1%, *n* = 292). More than one-third of patients (37.8%, *n* = 344) started ART

at age 35–44 years, and 60.2% (*n* = 494) were single, separated, or widowed. Overall, 46.4% (*n* = 422) of patients initiated ART in the period 2011–2014, and 90.1% of all patients (*n* = 802) were assessed to be at WHO clinical stage 1 or 2 at the time of their initiation. However, 45.4% (*n* = 413) of patients had a CD4 count of ≤ 200 cells/μL at ART initiation.

Most adult C-BART patients (85.5%, *n* = 778) were on ART for at least a year before they were down-referred. The remaining 14.4% were down-referred within a year after starting ART. The median length of time patients were on ART prior to down-referral was 45 months (IQR: 20−74), with Okongo patients down-referred earlier, after a median of 31 months (IQR: 14−57), as compared with 71 months (IQR: 45−92) for Eenhana C-BART patients and 63 months (IQR: 36−93) for Eenhana NIMART/C-BART patients. The median time that patients were on ART before an outcome event (i.e., until the date of death, loss to follow-up, ART stoppage, or transfer out of the health district, or until November 30, 2017, if the patient was alive and on ART at the end of the study) was 79 months (IQR: 51−104). Overall, patients were in C-BART, from down-referral to outcome event, for a median of 17 months (IQR: 9–32), with Okongo patients spending a median of 28 months (IQR: 10–61) in C-BART.

TABLE 2. PATIENT DEMOGRAPHIC AND CLINICAL CHARACTERISTICS AT ART INITIATION AMONG ADULT (≥ 15 YEARS) C-BART PATIENTS, OVERALL AND BY DISTRICT (N = 909)

Characteristic	All patients *n* (%)	Okongo	Eenhana	
		C-BART ***n*** (%)	C-BART ***n*** (%)	NIMART/C-BART ***n*** (%)
Overall ***N***	909 (100.0%)	504 (55.4%)	86 (9.5%)	319 (35.1%)
Sex				
Female	586 (64.5%)	294 (58.3%)	68 (79.1%)	224 (70.2%)
Male	323 (35.5%)	210 (41.7%)	18 (20.9%)	95 (29.8%)
Age at ART initiation				
15–24 years	41 (4.5%)	29 (5.8%)	4 (4.6%)	8 (2.5%)
25–34 years	279 (30.7%)	159 (31.6%)	30 (34.9%)	90 (28.2%)
35–44 years	344 (37.8%)	194 (38.5%)	33 (38.4%)	117 (36.7%)
45–85 years	245 (27.0%)	122 (24.2%)	19 (22.1%)	104 (32.6%)
Median age (IQR), years	38 (32–46)	38 (32–45)	37 (32–44)	39 (33–48)
Marital status				
Single/separated/widowed	494 (60.2%)	266 (59.1%)	52 (61.9%)	176 (61.3%)
Married/cohabitating	327 (39.8%)	184 (40.9%)	32 (38.1%)	111 (38.7%)
Unknown	88 (9.7%)	54 (10.7%)	2 (2.3%)	32 (10.0%)
Year of ART initiation				
2007–2010	396 (43.6%)	235 (46.6%)	36 (41.9%)	125 (39.2%)
2011–2014	422 (46.4%)	221 (43.8%)	40 (46.5%)	161 (50.5%)
2015–2016	88 (9.7%)	48 (9.5%)	9 (10.5%)	31 (9.7%)
2017	3 (0.3%)	0	1 (1.2%)	2 (0.6%)
WHO clinical stage at ART initiation				
1 or 2	802 (90.1%)	444 (89.2%)	77 (89.5%)	281 (91.8%)
3 or 4	88 (9.9%)	54 (10.8%)	9 (10.5%)	25 (8.2%)
Unknown	19 (2.1%)	6 (1.2%)	0	13 (4.1%)
CD4 count (cells/µL) at ART initiation				
< 100	112 (13.1%)	67 (13.8%)	11 (13.6%)	34 (11.8%)
100–200	301 (35.2%)	177 (36.4%)	26 (32.1%)	98 (34.0%)
201–350	313 (36.6%)	166 (34.2%)	32 (39.5%)	115 (39.9%)
351–500	78 (9.1%)	49 (10.1%)	8 (9.9%)	21 (7.3%)
> 500	51 (6.0%)	27 (5.6%)	4 (4.9%)	20 (6.9%)
Unknown	54 (5.9%)	18 (3.6%)	5 (5.8%)	31 (9.7%)
Median CD4 count (IQR)	204 (142–311)	200 (140–314)	208 (142–284)	208 (145–312)
Duration on ART from ART initiation to outcome event[a]				

Characteristic	All patients *n* (%)	Okongo	Eenhana	
		C-BART *n* (%)	C-BART *n* (%)	NIMART/C-BART *n* (%)
≤ 3 months	1 (0.1%)	1 (0.2%)	0	0
4–6 months	148 (16.3%)	62 (12.3%)	38 (44.2%)	48 (15.0%)
7–11 months	5 (0.6%)	1 (0.2%)	1 (1.2%)	3 (0.9%)
1–2 years	103 (11.3%)	63 (12.5%)	9 (10.5%)	31 (9.7%)
3–4 years	165 (18.2%)	83 (16.5%)	15 (17.4%)	67 (21.0%)
5–6 years	268 (29.5%)	147 (29.2%)	26 (30.2%)	95 (29.8%)
7–8 years	165 (18.2%)	101 (20.0%)	14 (16.3%)	50 (15.7%)
9–10 years	202 (22.2%)	108 (21.4%)	21 (24.4%)	73 (22.9%)
Median (IQR), months	79 (51–104)	81 (51–102)	78 (55–107)	78 (49–106)
Duration on ART from ART initiation to down-referral[b]				
≤ 3 months	29 (3.2%)	20 (4.0%)	0	9 (2.8%)
4–6 months	31 (3.4%)	26 (5.2%)	2 (2.3%)	3 (0.9%)
7–11 months	71 (7.8%)	58 (11.5%)	4 (4.6%)	9 (2.8%)
1–2 years	250 (27.5%)	180 (35.7%)	13 (15.1%)	57 (17.9%)
3–4 years	180 (19.8%)	99 (19.6%)	13 (15.1%)	68 (21.3%)
5–6 years	178 (19.6%)	71 (14.1%)	28 (32.6%)	79 (24.8%)
7–8 years	108 (11.9%)	30 (6.0%)	14 (16.3%)	64 (20.0%)
9–10 years	62 (6.8%)	20 (4.0%)	12 (14.0%)	30 (9.4%)
Median (IQR), months	45 (20–74)	31 (14–57)	71 (45–92)	63 (36–93)
Duration on ART from down-referral to outcome event[c]				
≤ 3 months	6 (0.7%)	3 (0.6%)	2 (2.3%)	1 (0.3%)
4–6 months	148 (16.3%)	62 (12.3%)	38 (44.2%)	48 (15.0%)
7–11 months	239 (26.3%)	80 (15.9%)	30 (34.9%)	129 (40.4%)
1–2 years	313 (34.4%)	156 (31.0%)	16 (18.6%)	141 (44.2%)
3–4 years	75 (8.2%)	75 (14.9%)	0	0
5–6 years	73 (8.0%)	73 (14.5%)	0	0
7–8 years	38 (4.2%)	38 (7.5%)	0	0
9–10 years	17 (1.9%)	17 (3.4%)	0	0
Median (IQR), months	17 (9–32)	28 (10–61)	8 (6–10)	11 (9–20)

[a] *Time from the date of ART initiation to the date of a patient's outcome event (died, LTFU, stopped ART, or transferred out of the health district) or the end of the study period (November 30, 2017) if the patient was alive and on ART on that date.*

[b] *Time from the date of ART initiation to the date of down-referral to C-BART.*

[c] *Time from the date of down-referral to C-BART to the date of a patient's outcome event (died, LTFU, stopped ART, or transferred out of the health district) or the end of the study period (November 30, 2017) if the patient was alive and on ART on that date.*

ADULT RETENTION IN CARE

In Okongo District, 90.8% of patients were still in care at 60 months from the time they were down-referred to C-BART. Among Eenhana District patients (C-BART and NIMART/C-BART), 100% were retained in care at 12 months, the maximum period of observation for these sites (Table 3).

TABLE 3. RETENTION IN C-BART CARE FOLLOWING DOWN-REFERRAL AMONG ALL ADULT (≥ 15 YEARS OLD) C-BART PATIENTS, OVERALL AND BY DISTRICT (N = 909)

Retention cohort[a]	*Number of patients followed (% retained)* [b]			
	All patients	Okongo	Eenhana[c]	
	n (%)	C-BART	C-BART	NIMART/C-BART
		n (%)	*n* (%)	*n* (%)
3 months	907 (99.7%)	503 (99.8%)	85 (98.8%)	319 (99.7%)
6 months	816 (99.1%)	461 (99.1%)	62 (98.4%)	293 (99.3%)
12 months	522 (99.0%)	364 (98.6%)	16 (100.0%)	142 (100.0%)
24 months	297 (96.0%)	297 (96.0%)	-	-
36 months	216 (94.0%)	216 (94.0%)	-	-
48 months	187 (93.0%)	187 (93.0%)	-	-
60 months	141 (90.8%)	141 (90.8%)	-	-

[a] *A retention cohort is a group of patients whose follow-up time from date of down-referral to date of outcome event is at least as long as the follow-up time specified.*

[b] *The percentage retained is the number of patients alive and on ART at the follow-up time specified, divided by the number of patients followed at least this long before their outcome event (died, LTFU, stopped ART, or transferred out of the health district, or alive and on ART at the end of the study).*

[c] *Because C-BART sites in Eenhana District were opened in 2016, C-BART and NIMART/C-BART patients were followed for less than 24 months.*

ADULT ART ADHERENCE

Adherence data were available for 345 (38.0%) of the 909 adults. Average ART adherence scores for adults for the 12 months prior to November 30, 2017, are presented in Table 4. Using the Namibia standard, 83.8% of Okongo patients achieved "good" adherence, defined by a score of ≥ 75%. In Eenhana District, adherence data were available for only 3 patients.

TABLE 4. ART ADHERENCE AMONG ADULT (≥ 15 YEARS) C-BART PATIENTS, OVERALL AND BY DISTRICT (N = 345)

Variable	All patients *N* = 345	Okongo C-BART *n* = 342	Eenhana C-BART *n* = 2	Eenhana NIMART/C-BART *n* = 1
Score category	***n* (%)**	***n* (%)**	***n* (%)**	***n* (%)**
≥ 95%	174 (50.4%)	174 (50.9%)	0	0
80%–94%	86 (24.9%)	85 (24.8%)	1 (50.0%)	0
< 80%	85 (24.6%)	83 (24.3%)	1 (50.0%)	1 (100.0%)
Median adherence score (%) (IQR)	95% (80–99)	95% (80–99)	61% (39–82)	0 (0–0)
Adherence by Namibia standard definition	***n* (%)**	***n* (%)**	***n* (%)**	***n* (%)**
Good adherence (≥ 75%)	289 (83.8%)	288 (84.2%)	1 (50.0%)	0
Poor adherence (< 75%)	56 (16.2%)	54 (15.8%)	1 (50.0%)	1 (100.0%)

ADULT VIRAL SUPPRESSION

The most recent VL test result was available for 884 of 909 adult patients (97.2%), and of these, 817 (92.4%) were alive and on ART as of November 30, 2017. Of these 817 adult patients, 781 (95.9%) had available information on the source of their VL test result. Among these 781 patients, the data source for the VL results was the health passport for 392 patients (50.2%), ePMS for 356 patients (45.6%), MEDITECH for 27 patients (3%), and PCBs for 6 patients (0.8%). Overall, 97.9% (*n* = 800/817) of patients alive and on ART at the end of the study period were virally suppressed, irrespective of whether their most recent VL test was performed before or after down-referral. Of the 545 patients whose most recent VL result occurred at least 4 months after down-referral, 97.6% (*n* = 532) were virally suppressed (Table 5). The VL results for 470 (86.2%) of these 545 patients occurred within a year of the end of the study period (November 30, 2017). Of 121 patients who were retained and in C-BART for 5–10 years, 119 (98.3%) were virally suppressed.

TABLE 5. VIRAL SUPPRESSION AMONG ADULT (≥ 15 YEARS OLD) C-BART PATIENTS, TOTAL, BY DURATION ON ART AFTER DOWN-REFERRAL AND BY DISTRICT (N = 817)

Duration on ART in C-BART	All patients *n* (%)	Okongo	Eenhana[a]	
		C-BART *n* (%)	C-BART *n* (%)	NIMART/C-BART *n* (%)
All patients[b]	800/817 (97.9%)	420/434 (96.8%)	80/81 (98.8%)	300/302 (99.3%)
Patients who had VL results 4+ months after their down-referral to C-BART[c]				
Total	532/545 (97.6%)	314/325 (96.6%)	28/28 (100.0%)	190/192 (99.0%)
4–6 months	13/13 (100.0%)	6/6 (100.0%)	2/2 (100.0%)	5/5 (100.0%)
7–11 months	105/108 (97.2%)	30/31 (96.8%)	11/11 (100.0%)	64/66 (97.0%)
1–2 years	237/242 (97.9%)	101/106 (95.3%)	15/15 (100.0%)	121/121 (100.0%)
3–4 years	58/61 (95.1%)	58/61 (95.1%)	-	-
5–6 years	65/66 (98.5%)	65/66 (98.5%)	-	-
7–8 years	38/38 (100.0%)	38/38 (100.0%)	-	-
9–10 years	16/17 (94.1%)	16/17 (94.1%)	-	-

[a] *Because C-BART sites in Eenhana District were opened in 2016, C-BART and NIMART/C-BART patients were followed for less than 24 months.*

[b] *Number and percentage of C-BART patients virally suppressed (≤ 1,000 copies/ml) as per their most recent VL test, up to the end of the study period (November 30, 2017).*

[c] *Number and percentage of C-BART patients who were virally suppressed (≤ 1,000 copies/ml) as per their most recent VL test, which occurred 4+ months after they were down-referred to C-BART.*

PEDIATRIC PATIENT CHARACTERISTICS

The demographic and clinical characteristics of the pediatric C-BART patients are presented in Table 6. The numbers of children from each district were similar, with 62 children (50.8%) from Okongo District and 60 children (49.2%) from Eenhana District. Overall, 68 patients (55.7%) were male. About half of the children, 50.8% (*n* = 62), initiated ART at ages 5–14 years, and 27.9% (*n* = 34) initiated at < 2 years of age. About half of the children (50.8%, n = 62), initiated ART during the period 2007–2010, and 41.8% (*n* = 51) initiated in the years 2011–2014. The majority of children (79.8%, *n* = 95) were at WHO clinical stage 1 or 2 at initiation, though 41.0% (*n* = 50) were assessed to have advanced or severe HIV immunodeficiency by CD4 count or percentage at ART initiation.

TABLE 6. PATIENT DEMOGRAPHIC AND CLINICAL CHARACTERISTICS AMONG PEDIATRIC (< 15 YEARS OLD) C-BART PATIENTS, OVERALL AND BY DISTRICT (N = 122)

Characteristic	All patients *n* (%)	Okongo	Eenhana	
		C-BART *n* (%)	C-BART *n* (%)	NIMART/C-BART *n* (%)
Overall ***N***	122 (100.0%)	62 (50.8%)	12 (9.8%)	48 (39.3%)
Sex				
Female	54 (44.3%)	25 (40.3%)	7 (58.3%)	22 (45.8%)
Male	68 (55.7%)	37 (59.7%)	5 (41.7%)	26 (54.2%)
Age at ART initiation				
< 2 years	34 (27.9%)	15 (24.2%)	4 (33.3%)	15 (31.2%)
2–4 years	26 (21.3%)	13 (21.0%)	3 (25.0%)	10 (20.8%)
5–9 years	40 (32.8%)	22 (35.5%)	2 (16.7%)	16 (33.3%)
10–14 years	22 (18.0%)	12 (19.4%)	3 (25.0%)	7 (14.6%)
Median (IQR), years	6 (2–9)	6 (2–9)	4 (2–9)	5 (1–9)
Year of ART Initiation				
2007–2010	62 (50.8%)	35 (56.4%)	7 (58.3%)	20 (41.7%)
2011–2014	51 (41.8%)	25 (40.3%)	3 (25.0%)	23 (47.9%)
2015–2016	9 (7.4%)	2 (3.2%)	2 (16.7%)	5 (10.4%)
2017	0	0	0	0
WHO clinical stage at ART initiation				
1 or 2	95 (79.8%)	53 (85.5%)	9 (75.0%)	33 (73.3%)
3 or 4	24 (20.2%)	9 (14.5%)	3 (25.0%)	12 (26.7%)
Unknown	3 (2.5%)	0	0	3 (6.2%)
Classification of HIV-associated immunodeficiency by CD4 count or percentage at ART initiation[a]				
Not significant	27 (28.7%)	12 (21.0%)	3 (42.9%)	12 (40.0%)
Mild	17 (18.1%)	8 (14.0%)	2 (28.6%)	7 (23.3%)
Advanced	21 (22.3%)	13 (22.8%)	1 (14.3%)	7 (23.3%)
Severe	29 (30.8%)	24 (42.1%)	1 (14.3%)	4 (13.3%)
Unknown	28 (23.0%)	5 (8.1%)	5 (41.7%)	18 (37.5%)
Duration on ART from ART initiation to outcome event[b]				
7–11 months	0	0	0	0
1–2 years	11 (9.0%)	4 (6.4%)	2 (16.7%)	5 (10.4%)
3–4 years	27 (22.1%)	12 (19.4%)	1 (8.3%)	14 (29.2%)
5–6 years	25 (20.5%)	13 (21.0%)	2 (16.7%)	10 (20.8%)
7–8 years	34 (27.9%)	23 (37.1%	2 (16.7%)	9 (18.8%)
9–10 years	25 (20.5%)	10 (16.1%)	5 (41.7%)	10 (20.8%)
Median (IQR), months	80 (49–104)	85 (57–103)	96 (51–120)	70 (45–102)
Duration on ART from ART start to down-referral[c]				

Characteristic	All patients *n* (%)	Okongo	Eenhana	
		C-BART *n* (%)	C-BART *n* (%)	NIMART/C-BART *n* (%)
≤ 3 months	2 (1.6%)	2 (3.2%)	0	0
4–6 months	5 (4.1%)	5 (8.1%)	0	0
7–11 months	11 (9.0%)	10 (16.1%)	0	1 (2.1%)
1–2 years	38 (31.2%)	24 (38.7%)	3 (25.0%)	11 (22.9%)
3–4 years	30 (24.6%)	17 (27.4%)	1 (8.3%)	12 (25.0%)
5–6 years	14 (11.5%)	3 (4.8%)	2 (16.7%)	9 (18.8%)
7–8 years	13 (10.7%)	1 (1.6%)	2 (16.7%)	10 (20.8%)
9–10 years	9 (7.4%)	0	4 (33.3%)	5 (10.4%)
Median (IQR), months	38 (20–69)	25 (12–38)	88 (44–113)	59 (37–92)
Duration on ART from down-referral to outcome event[d]				
≤ 3 months	1 (0.8%)	1 (1.6%)	0	0
4–6 months	22 (18.0%)	5 (8.1%)	6 (50.0%)	11 (22.9%)
7–11 months	29 (23.8%)	3 (4.8%)	6 (50.0%)	20 (41.7%)
1–2 years	33 (27.0%)	16 (25.8%)	0	17 (35.4%)
3–4 years	10 (8.2%)	10 (16.1%)	0	0
5–6 years	15 (12.3%)	15 (24.2%)	0	0
7–8 years	9 (7.4%)	9 (14.5%)	0	0
9–10 years	3 (2.5%)	3 (4.8%)	0	0
Median (IQR), months	16 (9–54)	51 (24–80)	7 (5–9)	10 (9–15)

[a] *Not significant = CD4 % > 35 for ≤ 11 months, CD4 % > 30 for 12–35 months, CD4 % > 25 for 36–59 months, or CD4 count > 500 for ≥ 5 years; mild = CD4 % 30–35 for ≤ 11 months, CD4 % 25–30 for 12–35 months, CD4 % 20–25 for 36–59 months, CD4 count 350–499 for ≥ 5 years; advanced = CD4 % 25–29 for ≤ 11 months, CD4 % 20–24 for 12–35 months, CD4 % 15–19 for 36–59 months, CD4 count 200–349 for ≥ 5 years; severe = CD4 % < 25 for ≤ 11 months, CD4 % < 20 for 12–35 months, CD4 % < 15 for 36–59 months, CD4 count < 200 or CD4 % < 15 for ≥ 5 years.*

[b] *Time from the date of ART initiation to the date of a patient's outcome event (died, LTFU, stopped ART, or transferred out of the health district), or to the end of the study period (November 30, 2017) if the patient was alive and on ART on that date.*

[c] *Time from the date of ART initiation to the date of down-referral to C-BART.*

[d] *Time from the date of down-referral to C-BART to the date of a patient's outcome event (died, LTFU, stopped ART, or transferred out of the health district), or to the end of the study period (November 30, 2017) if the patient was alive and on ART on that date.*

The median time pediatric patients were on ART was 80 months (IQR: 49−104). The median time spent on ART prior to down-referral was 38 months (IQR: 20−69), with Okongo children (as with the adults) down-referred earlier, after a median of 25 months (IQR: 12−38), as compared with 88 months (IQR: 44−113) for Eenhana C-BART children and 59 months (IQR: 37−92) for Eenhana NIMART/C-BART children. The median time pediatric patients were in C-BART (as of November 30, 2017) was 16 months (IQR: 9–54), but Okongo patients were in C-BART much longer, a median of 51 months (IQR: 24–80).

PEDIATRIC RETENTION IN CARE

Table 7 presents the number and proportion of pediatric patients retained in care at various time points (months from down-referral), overall and by district/site. The findings were similar to those for adults, and overall, > 95% of pediatric patients were retained in care across the various time points.

TABLE 7. RETENTION IN C-BART CARE FOLLOWING DOWN-REFERRAL AMONG ALL PEDIATRIC (< 15 YEARS OLD) C-BART PATIENTS, OVERALL AND BY DISTRICT (N = 122)

Retention cohort[a]	*Number of patients followed (% retained)* [b]			
	All patients	Okongo	Eenhana[c]	
	n (%)	C-BART	C-BART	NIMART/C-BART
		n (%)	*n* (%)	*n* (%)
3 months	122 (100%)	62 (100%)	12 (100%)	48 (100%)
6 months	110 (100%)	57 (100%)	8 (100%)	45 (100%)
12 months	71 (98.6%)	53 (100%)	0	18 (94.4%)
24 months	47 (97.9%)	47 (97.9%)	-	-
36 months	38 (97.4%)	38 (97.4%)	-	-
48 months	32 (96.9%)	32 (96.9%)	-	-
60 months	28 (96.4%)	28 (96.4%)	-	-

[a] A retention cohort is the group of patients whose follow-up time from down-referral to outcome event is at least as long as the follow-up time specified.

[b] The percentage retained is the number of patients alive and on ART at the follow-up time specified, divided by the number of patients followed at least this long before their outcome event (i.e., the date they died, were LTFU, stopped ART, or transferred out of the health district, or November 30, 2017, if they were alive and on ART at the end of the study period).

[c] Because C-BART sites in Eenhana District were opened in 2016, C-BART and NIMART/C-BART patients were followed for less than 24 months.

ADOLESCENT RETENTION IN CARE (AGES 10–19 YEARS)

Table 8 presents the number and proportion of adolescents retained in care at various time points (months), overall and by district/site. There were drop-offs at 24 and 36 months, though the numbers are very small.

TABLE 8. RETENTION IN C-BART CARE FOLLOWING DOWN-REFERRAL AMONG ADOLESCENT (10–19 YEARS OLD) C-BART PATIENTS, OVERALL AND BY DISTRICT (N = 30)

Retention cohort[a]	*Number of patients followed (% retained)* [b]			
	All patients	Okongo	Eenhana[c]	
		C-BART	C-BART	NIMART/C-BART
	n (%)	*n* (%)	*n* (%)	*n* (%)
3 months	30 (100%)	17 (100%)	3 (100%)	10 (100%)
6 months	29 (100%)	17 (100%)	3 (100%)	9 (100%)
12 months	17 (100%)	14 (100%)	0	3 (100%)
24 months	10 (90.0%)	10 (90.0%)	-	-
36 months	7 (85.7%)	7 (85.7%)	-	-
48 months	5 (100%)	5 (100%)	-	-
60 months	5 (100%)	5 (100%)	-	-

[a] *A retention cohort is the group of patients whose follow-up time from down-referral to outcome event is at least as long as the follow-up time specified.*

[b] *The percentage retained is the number of patients alive and on ART at the follow-up time specified, divided by the number of patients followed at least this long before their outcome event (i.e., the date they died, were LTFU, stopped ART, or transferred out of the health district, or November 30, 2017, if they were alive and on ART at the end of the study period).*

[c] *Because C-BART sites in Eenhana District were opened in 2016, C-BART and NIMART/C-BART patients were followed for less than 24 months.*

PEDIATRIC ART ADHERENCE

ART adherence among the children in C-BART, determined based on a patient's average adherence score in the 12 months prior to November 30, 2017, is presented in Table 9. We found that 63.6% of the children in Okongo District had scores of ≥ 75% ("good" adherence by Namibia standards); however, data were available for only 44 children. No adherence data were available for children in Eenhana District.

TABLE 9. ART ADHERENCE, BASED ON PATIENT'S AVERAGE ADHERENCE SCORE DURING THE 12 MONTHS PRIOR TO NOVEMBER 30, 2017, AMONG PEDIATRIC (< 15 YEARS OLD) C-BART PATIENTS IN OKONGO DISTRICT (N = 44)

Variable	Okongo C-BART *N* = 44
Score category	***n* (%)**
≥ 95%	19 (43.2%)
80%–94%	7 (15.9%)
< 80%	18 (40.9%)
Median adherence score (%) (IQR)	86 (65–99%)
Namibia standard definition	***n* (%)**
Good adherence (≥ 75%)	28 (63.6%)
Poor adherence (< 75%)	16 (36.4%)

VIRAL SUPPRESSION IN CHILDREN

The most recent VL test result was available for 118 pediatric patients (96.7%), and of these, 108 (91.5%) were alive and on ART as of November 30, 2017 (Table 10). Of these 108 pediatric patients, information on the source of the VL test result was available for 102 (94.4%). The sources were health passports for 60 patients (58.8%), the ePMS for 33 patients (32.3%), MEDITECH for 8 patients (7.8%), and PCBs for 1 patient (1.0%).

Of the 108 pediatric patients, 94 (87.0%) were virally suppressed. Of 74 patients whose most recent VL result occurred at least 4 months after down-referral, 86.5% (*n* = 64) were virally suppressed (Table 10). The VL results for 60 of the 74 patients with test results less than 4 months old (81.1%) occurred within a year of the end of the study period (November 30, 2017).

TABLE 10. VIRAL SUPPRESSION AMONG PEDIATRIC (< 15 YEARS) C-BART PATIENTS, BY DURATION ON ART AFTER DOWN-REFERRAL AND BY DISTRICT (N = 118)

Viral suppression (≤ 1,000 copies/ml)	All patients *n* (%)	Okongo	Eenhana[a]	
		C-BART *n* (%)	C-BART *n* (%)	NIMART/C-BART *n* (%)
All patients[b]	94/108 (87.0%)	43/51 (84.3%)	11/12 (91.7%)	40/45 (88.9%)
Patients who had VL results 4+ months after their down-referral to C-BART[c]				
Total	64/74 (86.5%)	35/43 (81.4%)	2/2 (100.0%)	27/29 (93.1%)
4–6 months	1/1 (100.0%)	0	0	1/1 (100.0%)
7–11 months	14/15 (93.3%)	1/1 (100.0%)	2/2 (100.0%)	11/12 (91.7%)
1–2 years	23/27 (85.2%)	8/11 (72.7%)	0	15/16 (93.8%)
3–4 years	7/8 (87.5%)	7/8 (87.5%)	-	-
5–6 years	10/12 (83.3%)	10/12 (83.3%)	-	-
7–8 years	6/8 (75.0%)	6/8 (75.0%)	-	-
9–10 years	3/3 (100.0%)	3/3 (100.0%)	-	-

[a] *Because C-BART sites in Eenhana District were opened in 2016, C-BART and NIMART/C-BART patients were followed for less than 24 months.*

[b] *Number and percentage of C-BART patients virally suppressed as per their most recent VL test (≤ 1,000 copies/ml).*

[c] *Number and percentage of C-BART patients who were virally suppressed as per their most recent VL test (≤ 1,000 copies/ml), with the test occurring 4+ months after they were down-referred to C-BART.*

VIRAL SUPPRESSION AMONG ADOLESCENTS

Viral suppression among adolescent patients was similarly high, though patient numbers are small (Table 11). Overall, 91.7% (*n* = 22) were virally suppressed, and 100% (*n* = 15) were virally suppressed more than 4 months after down-referral.

TABLE 11. VIRAL SUPPRESSION AMONG ADOLESCENT (10- TO 19-YEAR-OLD) C-BART PATIENTS, OVERALL AND BY DISTRICT (N = 24)

Viral suppression (≤ 1,000 copies/ml)	All patients *n* (%)	Okongo	Eenhana[a]	
		C-BART *n* (%)	C-BART *n* (%)	NIMART/C-BART *n* (%)
All patients[b]	22/24 (91.7%)	11/11 (100%)	3/3 (100%)	8/10 (80.0%)
C-BART patients who were virally suppressed 4+ months after down-referral to C-BART, total and by duration on ART[c]				
Total	15/15 (100%)	9/9 (100%)	0	6/6 (100%)
4–6 months	0	0	0	0
7–11 months	4/4 (100.0%)	1/1 (100.0%)	0	3/3 (100.0%)
1–2 years	8/8 (100.0%)	5/5 (100.0%)	0	3/3 (100.0%)
3–4 years	1/1 (100.0%)	1/1 (100.0%)	-	-
5–6 years	2/2 (100.0%)	2/2 (100.0%)	-	-
7–8 years	0	0	-	-
9–10 years	0	0	-	-

[a] *Because C-BART sites in Eenhana District were opened in 2016, C-BART and NIMART/C-BART patients were followed for less than 24 months.*

[b] *Number and percentage of C-BART patients virally suppressed as per their most recent VL test (≤ 1,000 copies/ml).*

[c] *Number and percentage of C-BART patients who were virally suppressed as per their most recent VL test (≤ 1,000 copies/ml), with the test occurring 4+ months after they were down-referred to C-BART.*

ADULT AND PEDIATRIC MORTALITY

There were 23 deaths recorded in ePMS, all from Okongo District. Characteristics of the patients who died are presented in Table 12. All deaths occurred among patients who started ART between 2007 and 2014. The mean age of the deceased patients was 44 years, 56.5% (*n* = 13) were male, and 61.9% (*n* = 13/21) were single, widowed, or divorced. The majority of deaths occurred from 2014 to 2016 (78.3%, *n* = 18), and the median duration on ART until down-referral for these patients was 15 months (IQR: 12–27). The median time spent in C-BART was 24 months (IQR: 16–44). The median time from last VL to death was 8 months (IQR: 1–13), and 67% (*n* = 12/18) had a VL result of < 1,000 copies/ml. The median CD4 count was 129 cells/µL (IQR: 87–248) at the start of ART, though only 3 patients were assessed to be in WHO clinical stage 3. Notably, 87.0% (*n* = 20) of patients' last visit dates were within 3 months of their death. When examining the treatment regimens, most of the patients had been transitioned to one of the current first-line regimens—(1) a combination of tenofovir disoproxil fumarate (TDF), lamivudine (3TC), and efavirenz (EFV); (2) a combination of zidovudine (AZT), 3TC, and nevirapine (NVP); or (3) a combination of TDF, 3TC, and NVP. None of the patients appeared to have been transitioned to second-line regimens.

TABLE 12. CHARACTERISTICS OF THE 23 DEATHS AMONG C-BART PATIENTS IN OKONGO DISTRICT

Year ART started	Age at ART start (yrs)	Sex	Marital status	Date of death	Duration from ART start to down-referral (mos)	Duration in C-BART from down-referral to death (mos)	Time from last clinic visit to death (mos)	Time from last VL to death (mos)	WHO clinical stage at ART start	CD4 count (cells/μL) at ART start	CD4 % at ART start	Original first-line regimen	Last substituted regimen	Latest WHO stage	Last VL result (copies/ml)
2007	53	M	—[a]	10/1/2014	37	53	2	7	2	154	11.1	D4T/3TC/NVP	TDF/3TC/EFV	2	1,348
2007	61	F	Married	2/1/2015	12	75	< 1	3	3	90	—	AZT/3TC/NVP	N/A[b]	T1	95
2007	78	M	Single	10/23/2014	12	79	1	23	1	181	—	D4T/3TC/NVP	AZT/3TC/NVP	T1	22
2008	26	F	Single	11/13/2012	21	33	1	—	2	148	19.9	AZT/3TC/NVP	TDF/3TC/EFV	1	—
2008	37	F	Married	7/30/2016	18	80	3	13	1	114	—	AZT/3TC/NVP	TDF/3TC/EFV	1	ND[c]
2008	38	F	Married	11/29/2014	39	32	< 1	36	2	113	12.9	AZT/3TC/NVP	N/A	2	208,542
2009	45	M	Married	5/14/2012	15	21	< 1	—	2	86	7.4	AZT/3TC/NVP	TDF/3TC/NVP	1	—
2009	45	M	Married	4/24/2017	71	24	2	8	3	87	11.6	AZT/3TC/NVP	TDF/3TC/EFV	T1	ND
2009	65	M	Single	6/3/2014	16	39	1	< 1	2	118	13.1	AZT/3TC/NVP	TDF/3TC/EFV	1	1,679,423
2009	68	F	Single	9/1/2014	15	51	< 1	34	3	63	12.7	AZT/3TC/NVP	N/A	1	454
2010	35	M	Single	4/22/2013	13	18	< 1	< 1	1	39	3.4	AZT/3TC/NVP	N/A	1	240,641
2010	47	M	Married	3/1/2015	6	44	6	12	1	290	12.7	AZT/3TC/NVP	TDF/3TC/NVP	1	158
2011	1	M	N/A	2/10/2015	14	30	< 1	< 1	1	991[d]	18	D4T/3TC/NVP	AZT/3TC/EFV	3	129,184
2011	27	F	Single	12/24/2013	10	16	1	—	1	345	28	TDF/3TC/NVP	TDF/3TC/EFV	1	—
2011	31	F	Single	3/11/2016	46	11	< 1	12	1	96	11	TDF/3TC/NVP	TDF/3TC/EFV	T1	ND
2011	35	M	Single	1/29/2014	15	18	2	—	1	254	—	TDF/3TC/NVP	N/A	1	—
2011	38	M	Single	8/1/2016	28	26	6	—	1	255	22	TDF/3TC/NVP	TDF/3TC/EFV	1	—
2011	65	F	—	10/1/2014	10	24	4	< 1	2	38	9	D4T/3TC/NVP	TDF/3TC/NVP	3	ND
2012	18	M	Single	7/30/2015	22	14	3	5	1	189	10.2	TDF/3TC/NVP	N/A	2	171,430
2012	52	F	Single	11/5/2015	27	12	2	9	2	41	—	TDF/3TC/NVP	TDF/3TC/EFV	T1	202
2012	55	F	Single	7/22/2014	5	20	3	12	1	129	8.3	TDF/3TC/NVP	N/A	1	191
2014	42	M	Married	7/11/2016	18	10	2	22	1	248	27.7	TDF/3TC/NVP	TDF/3TC/EFV	1	ND
2014	43	M	Married	8/1/2015	14	4	1	1	1	200	—	TDF/3TC/EFV	TDF/3TC/EFV	T1	ND

[a] *— = data not available.*

[b] *N/A = not applicable.*

[c] *ND = virus not detected or below the limit of detection of the particular assay.*

[d] *This patient had a CD4 percentage of 18% and was classified as having severe HIV-associated immunodeficiency at ART start.*

CDC representatives in the treatment waiting area located behind the C-BART structure. Heavy sands and rough terrain made it even harder to access this already remote site.

2.4 DISCUSSION

ADULT C-BART PATIENTS

Consistent with the national pattern in Namibia as well as the global pattern, two-thirds of the adult patients in C-BART care overall were women [4, 5]. The median age at ART initiation was 38 years, which is also consistent with trends observed in other countries in the region [9, 12]. The majority of patients had been initiated on ART in the period 2007–2014, and therefore patients were on ART from 3 to 10 years, affording a unique opportunity to examine long-term patient outcomes.

Adult retention in C-BART care was high among study participants, with 99% retained at 12 months, 96% at 24 months, 94% at 36 months, 93% at 48 months, and 91% at 60 months. These rates are similar to the MoHSS retention estimates for Okongo and Eenhana Districts, and are significantly higher than the national retention estimates of 89% at 12 months, 83% at 24 months, 79% at 36 months, 74% at 48 months, and 70% at 60 months [13]. C-BART retention is comparable to that of other community ART programs. Community adherence club studies from Tete Province in Mozambique reported retention rates of 98% at 12 months, 96% at 24 months, and 93% at 36 months [14, 15]. A community adherence club study in Roma District, Lesotho, also reported a 12-month retention rate of 98% [16]. All of these studies, however, involved programs that referred only stable patients to the community ART groups. It could be argued that these community ART groups had a built-in bias through their inclusion of only patients who were less likely to become LTFU or default on treatment.

In our evaluation, Eenhana more strictly applied the criterion that only stable patients should be referred to C-BART. In Okongo, the major criterion was patients' willingness to go to C-BART. This difference is reflected in the median time on ART before down-referral, which was about half for Okongo patients, 32 months, than it was for Eenhana C-BART and NIMART/C-BART patients, at 70 and 63 months, respectively. The finding that Okongo District included unstable patients yet had better retention and viral suppression outcomes than Eenhana, combined with the outcomes identified in the studies above, suggests that the C-BART model works for rural communities, including for patients not considered to be stable on ART at the time of down-referral.

The viral suppression rate of 97% at more than 4 months after down-referral confirms high ART adherence among C-BART patients. A paper in the CDC *Morbidity and Mortality Weekly Report* estimated viral suppression among all Namibia HIV patients for the period January 2015–June 2016 to be 87% [17]. Another report likewise presented a national viral suppression rate of 87%, based on data from the 2013 Namibia Demographic and Health Survey [18]. Data from population-based surveillance of HIV drug resistance from 3 sentinel ART sites in Namibia found that 93% of the 245 patients with VL data at 12 months were virally suppressed [19]. Thus, viral suppression among C-BART adults at 12 months appears to be even better than that shown in previous population-based surveys and evaluations.

The average adherence score also suggests high ART adherence among adults in C-BART care, with 84% of patients scoring ≥ 75% adherence and 50% scoring ≥ 95% adherence. These results are higher than those based on data from the MoHSS pharmaceutical management information system for 2017, which estimated that nationally, 62% of adults had an adherence score of > 75%, including 60% in Okongo District Hospital and 52% in Eenhana District Hospital [20]. A 2011 national baseline ART survey used a multi-method approach and categorized 8.2% of respondents as having high adherence (≥ 95% adherence) and 84.5% as having moderate adherence (75%–94% adherence) [21].

We found an apparent difference between WHO clinical staging and patient CD4 count, with the majority of patients (90%) considered to be at WHO stage 1 or 2 at ART initiation, whereas 48% had a low CD4 count (< 201), and 85% had a CD4 count of < 351. These results reinforce other studies suggesting that WHO clinical staging has poor validity and likely misses a high proportion of individuals who are ART-eligible by CD4 count [22]. Clearly, the overwhelming majority of patients were eligible for ART, with nearly half of them starting treatment with a CD4 count of < 200. This finding is consistent with the national

ART outcomes report for 2003–2012, which found that 64% of people on ART nationally had started ART with a CD4 count of < 200 [13].

Our finding that 20 of the 23 patients who died had a clinic visit within three months of their death needs further exploration. These patients may have been failing ART, but all of them were still on first-line ART regimens. This finding has implications for the quality of ART care. A comparison of the profile of the deceased patients with those still alive at the end of the study period suggests some differences in age at ART initiation, gender, duration in C-BART, and median CD4 count at ART initiation. The patients who died were older at ART initiation, with a median age of 42 years versus 38 years. While men made up 41% of living C-BART patients in Okongo District, 57% of the dead patients were men. The deceased patients also appeared to be in C-BART care longer, a median of 39 months, compared with the average of 26 months in Okongo District. The median CD4 count at ART initiation was 129 cells/µl, as compared with 204 cells/µl for all C-BART patients. The marital status profile was similar between living and dead patients, with approximately 60% being single, widowed, or divorced.

The higher proportion of male deaths is consistent with the findings of other sub-Saharan African studies that suggest men tend to seek HIV care later, when they are both older and sicker [23, 24]. While the deceased C-BART patients were in C-BART care longer than those still alive, studies have indicated that patients who initiate ART with low CD4 counts or severe or advanced disease are at higher risk of death than those who enter care with higher CD4 counts [25-27].

C-BART CHILDREN

C-BART children on ART tended to be diagnosed with HIV relatively late (median age 5 years, IQR: 1–9 years) and often to have advanced or severe disease (53%), in alignment with findings of many other studies in sub-Saharan Africa [28]. In Okongo District, children spent a median of about 3 years (39 months, IQR: 19–78) in C-BART, a fact that offered a unique opportunity to assess retention and viral suppression over time. A systematic review of HIV-infected children's retention in ART care found a typical total follow-up time of only 1–2 years [28]. Similar to the adults, however, C-BART children demonstrated high levels of retention: 99% at 12 months, 98% at 24 months, 97% at 36 and 48 months, and 96% at 60 months. These levels of retention compare favorably with national estimates from the 2003–2012 National ART Outcomes Evaluation Report, which were 92% retention at 12 months, 89% at 24 months, 87% at 36 months, 85% at 48 months, and 82% at 60 months [13]. They are also better than district estimates found in the same report for both Okongo (93.8% at 12, 91.9% at 24, 89.7% at 36, 88.4% at 48, and 85.9% at 60 months) and Eenhana [13]. C-BART retention numbers also compared favorably with figures from a systematic review that showed 12-month retention ranging from 71% to 95% [28]. Though the number of patients was small, adolescents in C-BART similarly demonstrated high levels of retention in care as well as viral suppression.

C-BART's high adolescent retention in care (100%) compares favorably with an analysis from the IeDEA (International Epidemiology Databases to Evaluate AIDS) global consortium, which showed that among adolescents who entered care before age 15 (similar to C-BART patients in that respect), the cumulative loss to follow-up was 27%, with 30% of adolescents LTFU (regardless of when they entered care) [29]. Factors associated with loss to follow-up in the IeDEA study included starting treatment at ≥ 5 years of age, being in care in a rural setting, and starting triple ART after 2006. Some evidence suggests that attrition is higher among adolescents and adults initiating ART at higher CD4 counts, which implies that they may not be experiencing HIV-related illness [30, 31]. Although our adolescent C-BART patients are rural, most initiated ART at younger ages and probably at lower CD4 counts. As part of a community-based cohort, these adolescents are likely affected by many of the same facilitators for retention as adults.

Although the number of patients was small, the high viral suppression among children (99%) and adolescents (100%) in C-BART compares favorably with results from other sub-Saharan African studies. The 2017 Namibia Population-Based HIV Impact Assessment survey estimated that viral suppression was 64% for females and 62% for males ages 0–14 years, and 65% for females and 61% for males ages 15–24 years [1]. A systematic review on adolescent viral suppression found that among

the 6 studies that reported viral suppression at 12 months after ART initiation, the proportion of adolescents with virological suppression varied from 27% to 89% [32].

ART adherence among the C-BART children appears to be lower than that observed among adults, with only 64% having an adherence score of ≥ 75% (versus 84% of adults). However, nationally, only 43% of children had an adherence score of ≥ 75%, and this percentage was 31% for Okongo District Hospital and 38% for Eenhana District Hospital [20]. C-BART pediatric adherence rates compare unfavorably with a pediatric cohort study from East Africa, where adherence on average was > 90%; studies in Uganda, where adherence was assessed to be 79%; and a study from Tanzania, where adherence measured by medication return was 97% [33-35]. However, in most of these studies, adherence was assessed by caregiver or patient report over a 7-day recall period, a measure that could be prone to overreporting. A Uganda study that compared adherence measures showed that 89% of pediatric patients had adherence scores of ≥ 95% using 3-day recall, but the same participants scored only 72% when adherence was measured by a home-based, unannounced pill count [36]. A South African study reported that 79% of children achieved an annual adherence rate, measured by medicine return, of ≥ 90% [37]. A Kenya study using the Medication Event Monitoring System (MEMS®) device, which records the percentage of doses taken, reported 79% adherence [38]. The studies in South Africa and Kenya measured adherence more similarly to the way C-BART measured it, yet adherence among C-BART children still appears to be low.

However, we found an 87% pediatric viral suppression rate more than 4 months after down-referral, which suggests that the C-BART adherence score may be less accurate than we thought. A similar finding was reported in an IeDEA study, which found viral suppression to be 69.2%–83.0% over a 3-year study period, with South African sites showing rates of about 80% over the study period [39]. In our C-BART evaluation, the adherence assessment measure may have been affected by the limitation that not all C-BART sites used the EDT system to capture pharmacy dispensing data at each visit. In addition, NIMART and C-BART sites in Eenhana District rely on sending paper-based reports to the district level to be captured in EDT, which may also have affected the timeliness and quality of adherence data.

CHALLENGES AND LIMITATIONS

One limitation of this evaluation is its reliance on data abstracted from patient health records, which may have quality issues such as missing data and data entry errors. Linking patients across the three database systems was a particular challenge, since no unique patient identifier was used across the stand-alone ePMS, EDT, and MEDITECH databases. However, we followed several steps to validly link individual patient records across these multiple databases. These included returning to the district ART clinics to validate a sample of records in the PCBs as the primary source of records, compared with data abstracted from the electronic databases, as well as manually updating/abstracting the EDT number from the EDT database using personally identifiable information from ePMS to verify the patient match. We also manually abstracted the most recent VL test result for every patient in the study database utilizing several data sources (health passport, ePMS, MEDITECH, and PCB).

We faced other challenges in data collection for key variables. The date of patient down-referral to C-BART is not captured in the current ePMS version; therefore, we had to manually abstract data from the health passports to obtain valid and complete information to measure duration in C-BART. We may also have missed data on up-referrals if these data were not documented in the facility records. Some sites rely on sending paper-based reports to the district level to be captured in the EDT, and this practice may have affected the timeliness, completeness, and quality of adherence data, possibly affecting adherence measures. There may also have been incomplete/missing data—an inherent challenge with the use of retrospective programmatic data—on viral suppression. Finally, there is no accurate national system to report AIDS-related deaths in Namibia; therefore, in this report we describe the reported deaths but avoid making inferences as to cause. Caution should be exercised in interpreting patterns in the death data presented.

2.5 CONCLUSION

The C-BART evaluation suggests that in comparison with national estimates for the region and overall national performance, the C-BART program was successful in achieving higher rates of retention, ART adherence, and HIV viral suppression among adults, adolescents, and children. C-BART retention was comparable to retention rates reported by other community ART programs including community adherence groups in other African countries.

Retention, adherence, and viral suppression were similar across facilities in Okongo and Eenhana Districts despite the fact that the six-month stability criterion was applied more systematically in Eenhana than in Okongo. This result brings into question the necessity of requiring that patients be stable on ART for six months before down-referral to C-BART sites.

Pre-fab structures offer privacy to clients receiving treatment, while the waiting area's corrugated iron roof provides respite from the sun.

Although the retention of children was comparable to that of adults in the C-BART program, adherence and viral suppression were markedly lower for children, suggesting the need for closer adherence support and VL monitoring for children in C-BART care. Nevertheless, compared with national pediatric estimates, a higher percentage of children in C-BART achieved viral suppression, confirming the limitations of using adherence as a reliable measure of treatment success, especially among children.

3. QUALITATIVE EVALUATION

3.1 METHODOLOGY

STUDY POPULATION

For the qualitative component, the study populations included policymakers and program managers at the national, regional, and district levels who were knowledgeable about the development of the C-BART program; patients who utilized C-BART sites; HCWs who provided services in C-BART sites; and HEWs who supported the services at the C-BART sites. The study populations and inclusion/exclusion criteria are presented in Section 3.3.

DATA COLLECTION

A study team of four research assistants (RAs) and a study coordinator was hired and trained in qualitative data collection, research ethics including the informed consent process, and the study protocol. During the training, the study instruments (interview and focus group discussion [FGD] guides) were piloted over one to two days on patients and HEWs at health facilities that were not participating in the study. These pilot interviews and FGDs were not recorded. Data collection involved the following:

- In-depth interviews (IDIs) with key informant policymakers and program managers, using a paper semi-structured interview guide
- IDIs with patients, using a paper semi-structured interview guide
- IDIs with HEWs, using a paper semi-structured interview guide
- FGDs with HCWs, using a paper discussion guide

Data collection took place from August through December 2017. IDIs with policymakers and program managers examined the conception and establishment of the program as well as the resources made available for it, how it could succeed/expand, and the policies, program guidelines, and resources that would be necessary to achieve these goals. The RAs interviewed the policymakers and program managers in English at their offices or in other private spaces.

Patient IDIs explored satisfaction with C-BART services; challenges to accessing the services at C-BART sites, including stigma, and medical and social issues potentially affecting ART adherence; and how C-BART programs could be more successful. RAs interviewed patients in Oshiwambo, the language commonly spoken in that region, at private spaces during C-BART sessions. Patients attending the clinic were asked if they wanted to participate in the evaluation.

IDIs with HEWs explored their views about the community's perspectives on and general acceptance of C-BART, including perceptions of the quality and type of services offered at the C-BART sites, issues of stigma, and other issues potentially affecting ART adherence. RAs also interviewed the HEWs in Oshiwambo during a C-BART session.

FGDs with HCWs explored their views about the C-BART program, including its effect on patients' ART adherence, the opportunities and challenges of providing services at C-BART sites, their perceptions of patients' experience of receiving services and the patients' challenges and opportunities with the program, and how the program could be improved. Project staff arranged for interested HCWs to attend FGDs at specific venues in the health facility at specified dates and times. The FGDs were scheduled to take place during regular working hours. Two RAs, a facilitator and note taker, conducted the FGDs. The FGDs were conducted in Oshiwambo or English, as appropriate.

All the participants provided written informed consent prior to the IDIs and FGDs, and all the interviews and discussions were audio recorded with the permission of the participants.

The typed notes and the audio recordings from the IDIs and FGDs were downloaded onto the server in Windhoek, Namibia. The RAs transcribed the audio recordings and translated from Oshiwambo to English in MS Word.

To assure data quality during the data collection, members of the project management team reviewed progress on the number of IDIs and FGDs completed, and adherence to the evaluation protocol. The study coordinator reviewed the completed study forms for errors before data entry, as well as reviewing a 10% sample of the IDI and FGD transcripts for accuracy of transcription and translation.

3.2 ANALYSIS

The study team created a code list based on the study objectives and findings in the data. Based on this list, the transcripts were coded using the qualitative software program MAXQDA®. We summarized the data using descriptive, text-based summaries and data display matrices. The team carefully read textual data to identify recurrent patterns and themes with regard to patient satisfaction, accessing services, and recommendations for improvement. We subsequently identified text excerpts that were illustrative of the themes identified.

We constructed a timeline showing the history of the C-BART program from conception to inception to implementation. Using a matrix, we compared policymakers' and program managers' responses on how the program evolved, and we described the leaders of the process, the stakeholders involved, the development of consensus, and how policies were changed and resources used. We also described key informants' opinions on the necessary policy and program changes, and the resources that would be needed for scale-up.

We compared and contrasted the views of the HCWs (including their perceptions of patients' views), patients, and HEWs, on the acceptability of the program, as well as their views on patients' drug adherence, focusing on commonalities in the comments. We similarly compared and contrasted their views on the limitations of the program, and their suggestions for improvement.

3.3 RESULTS

PARTICIPANT CHARACTERISTICS

Table 13 presents the demographic profile of participants in the qualitative component. The majority of the policymakers and program managers were in the age range of 35–44, while more than half of the HCWs and HEWs were ages 25–34. More than half of the patients interviewed were 45 and older. A slightly higher proportion of the policymakers and program managers were male (*n* = 6), while for all the other participants, the majority were female. All HCWs and HEWs had at least a secondary education, while 36 of the 40 patients interviewed had primary or no education. More than half of the patients were married or living with a partner. The policymakers and program managers had worked a median of 7 years (IQR: 2–11) in that position. About two-thirds (*n* = 18) of the HCWs had been working in that position for up to 4 years, and a similar number (*n* = 17) had worked at the C-BART sites up to 49 times. The majority of HCWs were health assistants (*n* = 9), followed by nurses (*n* = 5), with a pharmacy assistant, a laboratory technician, a community health worker, a data clerk, and a tuberculosis field promoter also participating in the FGDs (*n* = 5). Two HEWs had supported the C-BART sites for a year, and 5 HEWS had supported C-BART for 2 to 5 years. In answer to a question on time/distance, patients indicated that it took a median of 47.5 minutes to get to the C-BART site (IQR: 5–180).

TABLE 13. DEMOGRAPHIC PROFILE OF PARTICIPANTS IN QUALITATIVE COMPONENT

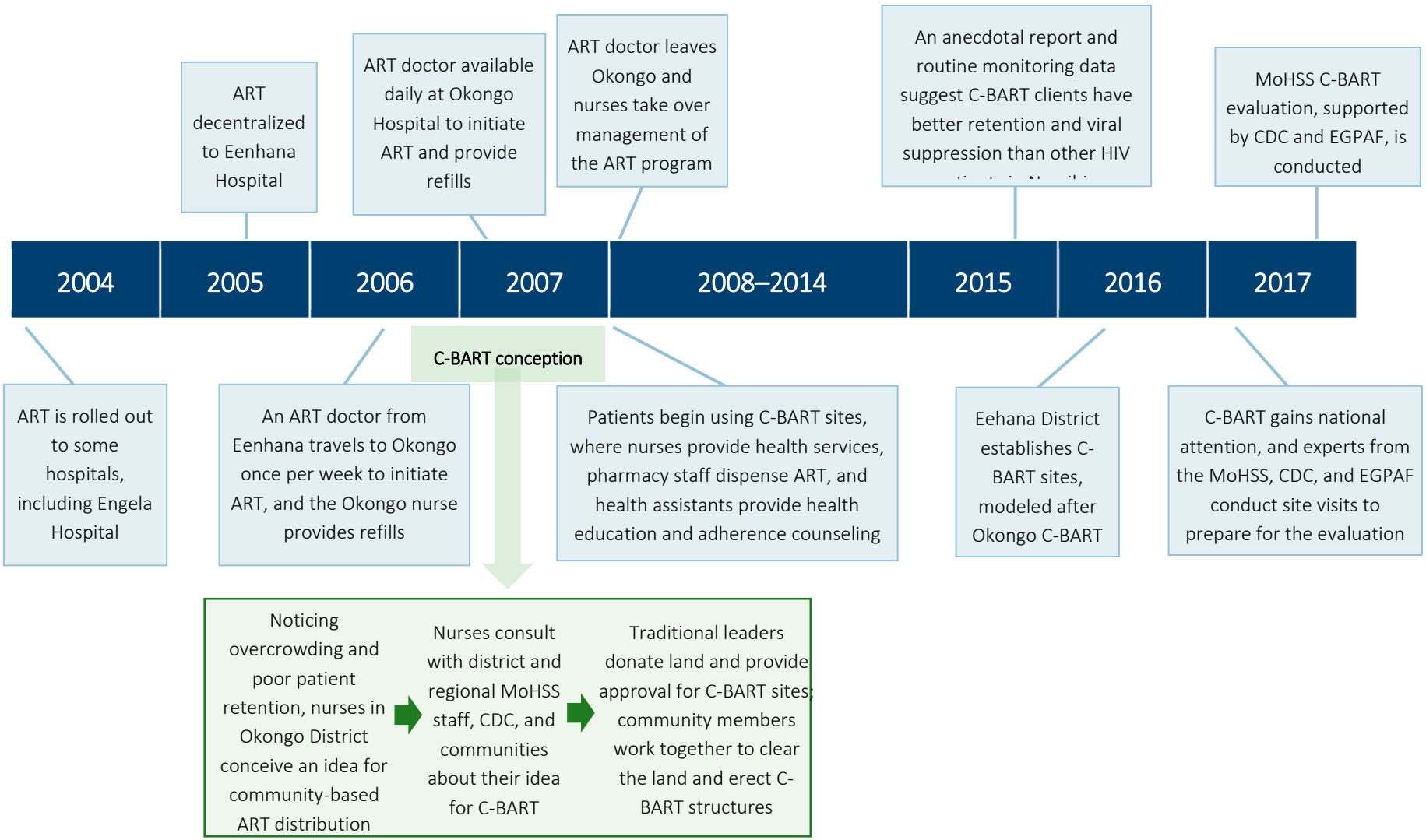
Characteristic	Policymakers/ program managers (*n* = 11)	HCWs (*n* = 26)	HEWs (*n* = 7)	Patients (*n* = 40)
Age				
25–34 years	*	15	5	2
35–44 years	*	9	1	16
45+ years	*	2	1	22
Sex				
Male	6	8	1	15
Female	5	18	6	25
Education				
No school	*	0	0	11
Primary	*	0	0	25
Secondary	*	17	7	4
Tertiary	*	9	0	0
Marital status				
Married/lives with partner	*	*	*	23
Never married	*	*	*	9
Separated/divorced	*	*	*	2
Widowed	*	*	*	6

** Question not asked of this group.*

CONCEPTION AND IMPLEMENTATION OF THE C-BART PROGRAM

Figure 3 shows a timeline of the history of the C-BART program, from conception to inception to implementation.

FIGURE 3. HISTORY OF THE C-BART PROGRAM



The conception of C-BART occurred from 2006 to early 2007, when nurses noted overcrowding at Okongo District Hospital. Patients would arrive in groups from one vehicle because they shared the high transportation costs and no public transportation system existed. The overcrowding resulted in long waiting times, patients missing their appointments, and poor patient adherence to ART. Many of the patients were also weak and struggled to get to the hospital. In response, nurses conceived the idea of taking services to the patients.

Interviews with policymakers and program managers confirmed the finding that nurses at the main hospital centers, in particular Okongo, had suggested the idea of providing treatment nearer to patient residences to alleviate severe crowding and high workloads at hospitals. Table 14 presents these findings. Subsequent outreach to village leaders found support, and community members cleared land and built traditional structures for the treatment sites. Some communities, however, were less supportive because they had thought the services would be more comprehensive and not for HIV-positive patients only. Some nurses were also not supportive, due to the difficult working conditions in the community, long distances to cover, and long work days that had them returning to the hospitals very late. They were also concerned that the program was not sustainable.

Because the C-BART program began as a hospital outreach, it had no training, no guidelines, and initially no documentation or monitoring system separate from that of the hospital. Also, transportation for the nurses and other HCWs was sometimes challenging because vehicles were often not released in time, and the capacity of the vehicles limited the number of staff that could participate in C-BART visits. However, the program grew rapidly over time, gaining significant support from the communities and patients due to the significant reduction in patient transportation costs. Additionally, the reduction in travel let patients save time that they could spend in income-generating activities. Over time, market activities, whereby patients and community members engaged in buying and selling goods and services, sprung up at the C-BART sites, further adding to community support.

TABLE 14. POLICYMAKERS' AND PROGRAM MANAGERS' VIEWS ON THE CONCEPTION AND IMPLEMENTATION OF THE C-BART PROGRAM

Theme	Findings
C-BART conception	HCWs observed crowded facilities and poor adherence among patients due to transportation challenges. Patients traveled in groups to split the expensive transportation costs (due to long distances and poor roads that require four-wheel-drive vehicles). Weak patients struggled to make the journey to retrieve medication. HCWs believed that bringing the services to the communities would alleviate overcrowding by large groups arriving at the facility and improve patient adherence. In Okongo, any patient who was willing to participate was potentially eligible to be in the program. When the Eenhana program was started, the eligibility criteria for participation in C-BART were a suppressed VL and willingness to participate.
Preparation and involvement	Village leaders gave approval to set up the sites and selected the locations, and community members cleared out land and built the structures using locally available materials. In some cases, members contributed their own money to establish physical structures or to improve existing sites.

Theme	Findings
Reception of idea	Nurses were supportive of C-BART due to its potential to reduce their workload. Initially patients were apprehensive due to stigma, but over time they realized the benefits. Some community members disapproved of the services because they were not comprehensive but only for HIV-positive patients. Some nurses were not supportive because of the more difficult working conditions, working long hours with no food or water and often returning home late in the evening because of the distance. National-level pharmacists initially had concerns about environmental needs of the medications (e.g., refrigeration) as well as drug management, dispensation, and accountability. At the regional level, though, pharmacists did not seem to have these concerns.
Implementation barriers	No C-BART curriculum or training, nor standard operating procedures or guidelines exist. There is limited or lack of transportation to the sites, as well as limited space for HCWs in the vehicles. No separate register or monitoring system exists for C-BART; it was initially combined with the hospital registers and documentation for ART.
Implementation facilitators	Community support and participation increased over time due to the significant reduction in (patient transportation) costs. Introduction of the HEWs, who linked patients to the C-BART program, provided patient support and prevented loss to follow-up. Unsupportive nurses began to see the benefit of less crowded facilities and better patient adherence.

ACCEPTABILITY AND CHALLENGES OF THE PROGRAM

We explored the views of patients, HEWs, and HCWs on the acceptability and challenges of the C-BART program, as well as changes over time, through IDIs with patients and HEWs, and through FGDs with HCWs. These findings are summarized in Tables 15–17.

Aside from the reduction in the time and financial burden of travel, another important facilitator for medication adherence in the program may have been patients' concern about being referred back to the hospital for management and follow-up ("up-referred") if they were not adhering to their drugs. Being up-referred would entail time and transportation costs. Barriers to the C-BART program included the inconsistent arrival and departure times of the HCWs, lack of privacy and poor infrastructure (for example, receiving services under a tree), and fragmented services.

TABLE 15. SUMMARY OF THE FACILITATORS OF AND BARRIERS TO UTILIZATION OF THE C-BART PROGRAM

Facilitators	Barriers
Less financial burden on family members to support patient's travel to main clinics (patients, HEWs)	HIV testing and initiation on ART before referral to C-BART (HCWs)
Less interference in time spent generating an income (patients)	Fragmented services (HCWs, patients)
Importance of no cost and short distances (patients, HCWS, HEWs)	Inadequate infrastructure (no proper seating; direct exposure to elements/environmental conditions such as rain, heat, animals) (patients, HCWs, HEWs)
Encouragement from HCWs, community leaders, and other patients (patients)	Lack of privacy (patients, HCWs, HEWs)
Having a number of services offered (patients)	Safety is compromised (HCWS)
Someone else can pick up medication for you (patients)	Inconsistent arrival and departure times of HCWs (patients)
Short queues and fast services (patients)	Illegible handwriting of HCWs on follow-up dates (patients)
Multiple sources' (other patients') knowledge of the C-BART schedule helps you remember your visit (patients)	Proximity of C-BART sites to bars and schools results in children's shying away (patients)
Increased accountability because patients know that poor adherence may result in their being up-referred to the main site (HCWs)	No fixed operating times (patients)

SUCCESSES OF THE C-BART PROGRAM

The successes of the program, as articulated by the HCWs, HEWs, and patients, included increased ART adherence, decreased HIV-related stigma, less death in the community, and reduced time and transportation costs. Challenges included limitations on transportation for HCWs to the sites, rude or drunk patients, inadequate training for the HEWs, and drug shortages at the sites. On occasion, HCWs would run out of drugs on C-BART visits, either because they did not pack sufficient supplies or because the number of patients attending was more than anticipated. Table 16 summarizes the successes and challenges of the C-BART program.

TABLE 16. SUMMARY OF THE SUCCESSES AND CHALLENGES OF THE C-BART PROGRAM AS VIEWED BY THE HCWS, HEWS, AND PATIENTS

	HCWs	HEWs	Patients
Successes	Seeing patient confidence in both status acceptance and ability to adhere to their ART regimens, and seeing patients tell others about their treatment success Increased community knowledge about viral suppression Decreased stigma Increased community ownership Having enough time to work with clients "Walking testimonies" encourage other people to seek treatment through C-BART services	Noticing fewer HIV-related deaths in the community Patients are more open and willing to communicate their issues HEWs are able to call HCWs with questions HEWs are able to help with educating patients and increasing awareness HEWs believe they make a difference	Reduction of cost and distance More money for other commodities Better emotional well-being and less tiredness
Challenges	Delayed authorization and release of vehicles for C-BART visits Transportation options limit the number of outreach staff (based on available seats in vehicle) Lack of timely laboratory specimen processing due to late arrival at the facility Inadequate infrastructure (no electricity for sample storage, clean water, etc.) Rude or drunk patients, late patients	Understanding the appropriate method to provide criticism or complaints Limited training on HIV adherence counseling Outdated adherence books Transportation Some patients and HCWs prefer not to engage with HEWs Feeling guilty when patients have poor outcomes Needing more training, specifically around HIV and ART	Lack of HIV testing, counseling, and health education Stock-outs of medication Inadequate infrastructure Lack of privacy Stigma from other community members

SUMMARY OF CHANGES OVER TIME

Table 17 summarizes the changes in the program over time as expressed by HCWs and patients. Changes include better patient retention and adherence, less crowding and shorter waiting times at the main facilities, introduction of HEWs, increased HCW job satisfaction, reduction in HIV-related stigma, and improved structure at C-BART sites.

Table 17. Summary of changes over time as expressed by HCWs and patients

HCWs	Patients
Less crowding and shorter waiting times at the main facilities	Contribution of money to improve the structures
Increased HCW satisfaction due to lighter work burden for those working at the facility	Initial stigma but later community acceptance
Increased patient adherence because patients do not want to be sent back to the main clinic due to high VL	Increasing numbers of patients
Decrease in patients' missed appointments	Increased privacy due to modifications to the sites
Additional staff—HEWs—allowed nurses to spend more time with patients	C-BART sites began to be utilized for other community meetings and public health services
Less waiting time	Sanitation improved at sites
Additional vehicles—C-BART vehicles dedicated to taking HCWs to deliver services	
Prefabricated units allowed for the integration of other services	

RECOMMENDATIONS TO IMPROVE THE C-BART PROGRAM

Recommendations from policymakers, program managers, HCWs, and patients for improving the program are presented in Table 18. They include developing a monitoring and reporting system specifically for C-BART, developing standard operating procedures for the activities at C-BART sites, and training and structural improvements at the sites. Patients essentially wanted more services at the C-BART sites, including an ambulance service.

TABLE 18. RECOMMENDATIONS SUGGESTED BY POLICYMAKERS/PROGRAM MANAGERS, HCWS, AND PATIENTS

Policymakers/program managers/HCWs	Patients
Implement the electronic monitoring systems already in place (ePMS, EDT, etc.)	Add more services, such as cervical cancer screening, eye care, and immunization
Establish a separate reporting system for the C-BART sites	Add health education, especially for youths
Keep track of the dates of patients' down-referral to C-BART sites	Add ambulance service at the sites
Develop standard operating procedures, including eligibility criteria for services and what services are offered	Open daily
Update traditional sites to prefab containers	Have consistent starting and ending times
Add training for HEWs and HCWs	Store necessary equipment at the sites
	Allow children to be seen first or on weekends
	Add a fence around the site to make it look more professional and provide protection
	Provide clear directions to the sites
	Make the seating area more comfortable
	Provide more shaded area

3.4 DISCUSSION

Although the patient participants in the qualitative analysis were not necessarily representative of the demographic profile of the C-BART patients described in the quantitative analysis (for example, the median age at initiation of all adult C-BART patients was 38 years, whereas the patients interviewed were more likely to have been 45 and older at initiation). In general, interviewed patients tended to be older, less educated women.

The timeline and description of the evolution of C-BART, based on findings from the IDIs and FGDs on the conceptualization and implementation of the program, suggest that the absence of a full-time, permanent doctor for ART initiation and monitoring at Okongo from 2005 to 2007 set the stage for nurses to be empowered to develop C-BART. Nurses are often more attuned to the needs of patients and the community, because they may come from the same communities and may be closer to their patients socially. Doctors, on the other hand, may be socially distant from patients and are less likely to come from the communities they serve—or even from the same country in the case of Namibia, since the first Namibian-trained doctors graduated only in 2016 from the University of Namibia School of Medicine. As with other community ART initiatives, the saving of travel time and expense, and the potential positive impact on retention and adherence were important factors influencing the development of the C-BART program [40].

The community leaders' and members' approval of C-BART, donation of land, and participation in land clearance and structure building engendered community ownership and established a partnership between the community and health facility staff to support HIV-positive community members. Thus, the community leaders had a stake in encouraging patients to attend the C-BART services and to remain engaged.

The visibility of the activity (C-BART sites are open for anyone to see) may also have contributed to a reduction in HIV stigma in the community. A study of community adherence groups, or CAGs (groups of ART patients who take turns collecting the

ART medications for all group members and distributing them) in Tete, Mozambique, reported that key informants indicated a significant reduction in HIV stigma in the community because of the existence of CAGs [41]. Similar to our findings, the study also reported that key informants perceived an improvement in the quality of care with the implementation of C-BART , and a significant reduction in workload.

The lack of privacy and inconsistent arrival and departure times of the HCWs are structural barriers. Though most C-BART sites are convenient gathering places in the community, they nevertheless may have limited infrastructure. Some patients may sit on a rock or under a tree when receiving services, given the nature of the terrain in these areas. Since there is often no building, there is also no privacy for exams and discussions between the patient and HCW. To date, with support from PEPFAR (the U.S. President's Emergency Plan for AIDS Relief), some sites have been upgraded to prefabricated buildings or other physical structures, which provide much more privacy. Patients are more likely to attend services if they have more privacy, feel comfortable, and are protected from the elements. With time, we expect more C-BART sites may have improved structures. The inconsistency of the HCWs' arrival and departure times is related to transportation availability and could be improved through better planning of processes and addition of more vehicles.

The recommendations made by policymakers, program managers, HCWs, and patients included many suggestions to strengthen the health system. Their suggestions for improvements in the M&E systems, development of standard operating procedures for services, and training for the HEWs and HCWs would likely strengthen C-BART services, providing further structure to the program. Given that community health workers are increasingly seen as an important cadre for providing education and care to patients, training for HEWs, particularly in enhanced HIV/ART education and counseling, would be useful to support long-term adherence in the way that this community cadre tracks and supports C-BART patients [42]. Training for nurses in ART/HIV care would also be useful to strengthen the services.

Patients also recommended providing comprehensive services through C-BART, a move that could also improve patient retention. In particular, providing cervical cancer screening could enhance HIV care, given the higher risk HIV-positive women face for this condition.

LIMITATIONS

Challenges in implementing the IDIs include the potential for response bias (respondents may report what the interviewer would like to hear), differential nonresponse (participants who refuse to be interviewed may be different from those who agree to participate), and recall bias (participants may selectively recall stakeholders and events). The semi-structured nature of the interviews required skilled interviewers to avoid the potential of inconsistencies in the data gathered. Skilled facilitation was also essential for FGDs, which rely on assisted discussion to control and manage participants, and to generate useful information. These potential biases were mitigated by carefully selecting experienced interviewers and FGD facilitators, and by training them with an emphasis on the intent of the discussion probes and questions, and the importance of building rapport with the participants.

3.5 CONCLUSION

The C-BART program appears to be well accepted and supported by the patients, community, HCWs, program managers, and policymakers. The program appears to have responded to a need in a rural, sparsely populated region of Namibia, and in doing so, to have engaged communities, community leaders, and patients in a way that involved them as partners with the HCWs and program managers in supporting patients on ART, with potential positive outcomes for all stakeholders. If implemented, many of the recommendations made by participants in the qualitative analysis would strengthen and improve the C-BART program.

4. EVALUATION OF COSTING DATA

4.1 METHODOLOGY

To estimate the resources needed to implement the program, costing data were extracted from inception documents and program reports using a resources costing tool. Data included the following:

- Detailed budgets, and financial and other reports on the investment costs
- Renovation/construction costs for the C-BART sites
- Recurrent costs, such as personnel and travel costs
- Cost of additional supplies needed for C-BART sites

4.2 COST ANALYSIS

The cost analysis takes a service provider's perspective—that is, all costs associated with delivering services under the C-BART program are included, with the exception of the costs of antiretroviral (ARV) medicines, VL monitoring, and other laboratory-related investigations. We exclude the latter because those costs do not differ from ART provided under a facility-based model, and the purpose of this analysis is to understand the costs that are specific to implementing the C-BART program.

By using a service provider perspective, we also do not capture societal costs, such as waiting times or transportation costs for patients. Although these costs are critical to consider because community-based ART models typically bring significant savings to patients in terms of waiting time and transportation costs [7], they are beyond the scope of this analysis, which is focused on the total resources required by a C-BART implementer. Additionally, we do not capture the potential time savings at the main health facilities due to the reduced number of patient visits as a result of these decentralized ART distribution points, which, again, is a key part of the value proposition associated with implementing community-based ART but beyond the scope of this study.

Five key cost elements are associated with implementing the C-BART program:

- Capital costs (minor engineering modifications, vehicles)
- Clinical/site supplies
- Labor
- Travel/transportation
- Monitoring, supervision, and review

We captured costs in Namibian dollars (NAD) and then converted them to U.S. dollars (USD) using the exchange rate as of December 31, 2017, of 12.38 NAD to 1.00 USD.[2]

CAPITAL COSTS

MINOR ENGINEERING MODIFICATION OF SITES

For each of the C-BART sites, land was provided by the traditional authorities at no cost. For 8 of the total 34 sites, it was necessary to purchase prefabricated units, which were modified for use in providing basic health services. We included these costs but divided them by 2, since it was estimated that approximately half of the utilization of these units was for the delivery

[2] https://www.oanda.com/currency/converter/.

of primary health services not related to ART. Using a useful life of 30 years, and assuming a salvage life of 0 at the end of that period, we calculated a straight-line annual depreciation value.

It is important to note that we did not include the small amount of resources raised by the communities themselves (in addition to the land itself) to perform basic repairs and purchase roofing materials. A future study should try to understand and estimate the amount of resources mobilized by communities to facilitate the provision of C-BART, because it not only may make up a not insignificant component of the total costs, but also has implications for the sustainability of the investment.

VEHICLES

With funding from PEPFAR through the CDC under the Treatment Acceleration Plan, two vehicles were purchased in 2015 to assist with transportation of HCWs to C-BART sites in Okongo and Eenhana Districts. We considered the actual costs for these vehicles, and assuming a useful life of five years and a salvage value of zero at the end of that period, we calculated the straight-line annual depreciation value for each of the vehicles. Because the vehicles were also used by other departments and programs from those districts, the project implementation team estimated that its utilization rates for C-BART were 30.0% and 38.3% for Okongo and Eenhana, respectively, based on the number of visits to sites as a proportion of working days in a year. These percentages were then multiplied by the annual depreciation value to determine an annualized cost for the vehicles.

CLINICAL/SITE SUPPLIES

We compiled the costs for all clinical and site-level supplies purchased for the C-BART sites on a one-time basis over a one-year period. Items ranged from weighing scales and height boards to thermometers and stethoscopes, as well as examination beds and desks.

Items were classified into durable items with a useful life of more than a year, and items that may need to be replaced annually. Durable items were then assigned an annual depreciation value, based on their actual cost and a useful life of three years. Other items' full costs were captured as an annual cost.

LABOR

To calculate human resource costs, first, we compiled a list of all the positions making up the district team that provides services to C-BART sites. For Okongo, the C-BART district team typically comprises a nurse, a pharmacist assistant, a health assistant, an administrative officer (data clerk), and a driver. For Eenhana, the team has a different composition, with three nurses, a pharmacist assistant, a health assistant, and a driver, but no administrative officer. The two districts' staff complements differ based on patient volume and the number of NIMART clinics supported by the district ART team. The patient volume at NIMART sites in Eenhana is triple that of Okongo. We estimated the total number of hours each of these cadres worked in delivering C-BART services over the course of a one-year period, and multiplied by the hourly salary. The hourly rate was calculated by dividing the worker's monthly compensation by 160, assuming an average of 160 working hours per month.

TRAVEL/TRANSPORTATION

This category consisted mainly of the recurrent costs associated with the vehicles transporting the mobile team to the various C-BART sites. Specifically, these costs included fuel, maintenance, and vehicle registration and licensing.

To estimate the cost of fuel, we compiled the number of visits to each site over the course of the year and the round-trip distance to each site. We multiplied the result (km traveled per year) by the current cost of fuel, 10.99 NAD per liter, and assumed a fuel consumption of 10 km/liter, for an estimated cost of fuel of 1.10 NAD per km, or 0.09 USD per km.

MONITORING, SUPERVISION, AND REVIEW

Regional clinical mentors from Ohangwena Region, or members of the district coordination committee, visit each C-BART site annually. No additional costs are associated with this supervision beyond the additional cost of fuel to undertake the visit. We assumed an average round-trip distance of 100 km, an average cost of fuel of 10.99 NAD per liter, and fuel consumption of 10 km per liter, to estimate annual fuel costs for C-BART supervision visits.

OTHER COSTS

Finally, in some areas, costs may be relevant but are not included because no additional costs were incurred over the study period:

TRAINING

No specific trainings were undertaken for the purpose of introducing the C-BART program. Some HCWs did participate in routine trainings on ART guidelines, which did cover differentiated models of care, but there were no trainings specific to C-BART, so training expenditures were not included.

PLANNING

Though there was definitely an investment of time and resources in planning for C-BART implementation, these costs were integrated into the costs of existing meetings and consultations. For example, meeting with community leaders was a critical component of C-BART planning. However, such meetings occurred during scheduled primary health care visits to those communities. Beyond that, expert patients, community volunteers, support group members, and HEWs continued to engage with community leaders. Patients, in particular, played a major role in communicating with traditional community leaders to acquire land for C-BART sites. Similarly, several planning discussions were held at the central, regional, and district levels within MoHSS, but these were conducted as part of routine regional-level meetings; district-level weekly, monthly, quarterly management, and technical planning meetings; and national-level treatment technical working group meetings.

COMMUNICATION

Communication to facilitate follow-up with patients after missed appointments and coordinate visits from the district health team can be a critical cost. However, no additional communication costs were incurred for implementation of C-BART. C-BART sites have no landline and limited access to the cellular network. If staff need to reschedule appointments or follow up with patients, they do so using the referral hospital's landline.

4.3 RESULTS

The findings of the costing study are grouped into capital costs (minor engineering modifications, vehicles); clinical/site supplies; labor and travel/transportation; and monitoring, supervision, and review.

CAPITAL COSTS

MINOR ENGINEERING MODIFICATION OF SITES

Assuming a useful life of 30 years and 0 salvage value at the end of that period, we calculated an annual depreciation value of 3,238 USD for the purchase and modification of prefabricated units to serve as C-BART sites on land provided by community leaders (see Table 19). These costs were split proportionally across Okongo and Eenhana Districts based on the number of C-BART sites in each district. Costs in Okongo were estimated at 1,573 USD and costs for Eenhana at 1,665 USD. Community members and patients receiving services at C-BART sites raised funds to erect the initial C-BART structures using traditional and locally available wall and roofing materials. Later, minor engineering modifications were made at the eight C-BART sites

that received the prefabricated units; costs for minor improvements at sites that did not receive prefabricated units are not included here.

TABLE 19. MINOR ENGINEERING MODIFICATION COSTS

Item	Cost (USD)
Prefabricated unit—unit cost (A)	$24,281
No. of prefabricated units purchased for C-BART sites (B)	8
Utilization rate for C-BART (C)	50%
Useful life (years) (D)	30
Annual depreciated value (A × B × C)/(D)	$3,238

VEHICLES

We estimated annualized costs of 3,189 USD for Okongo and 3,373 USD for Eenhana for the vehicles (Table 20). This calculation is based on actual purchase prices for the vehicles involved in providing C-BART services in Okongo and Eenhana, respectively, as well as a useful life of five years, zero salvage value at the end of that period, and utilization rates based on the number of site visits conducted by each vehicle during the year.

TABLE 20. CAPITAL COSTS—VEHICLE PURCHASE

Item	Okongo (USD)	Eenhana (USD)
Vehicle (Toyota Land Cruiser for Okongo, Toyota Hilux for Eenhana) (A)	$53,148	$44,030
No. of vehicles purchased for C-BART (B)	1	1
Utilization rate for C-BART (C)	30%	38.3%
Useful life (years) (D)	5	5
Annual depreciated value for C-BART (A × B × C)/(D)	$3,189	$3,373

CLINICAL/SITE SUPPLIES

Site-level supplies were classified as either durable (those with a useful life of more than three years) or nondurable (those likely to be replaced annually). The items are summarized in Tables 21a and 21b. For durable items, costs were divided by the useful life to determine an annualized cost. These costs were then allocated across Okongo and Eenhana Districts based on the number of C-BART sites in each district. Total costs across both districts and all items were estimated at 23,671 USD.

TABLE 21A. SITE SUPPLIES—DURABLE ITEMS

Item	Annually depreciated cost (USD)	
	Okongo (16 sites)	Eenhana (18 sites)
Patient chair	$499	$528
Nurse/provider chair	$393	$416
Partition screen	$393	$416
Desk	$446	$472
Bedside medical trolley	$674	$714
Examination bed	$619	$656
Weighing scale (adult)	$418	$443
Weighing scale (pediatric)	$398	$422
Height board	$278	$294
Stepping bench	$168	$178
Steel cabinet	$382	$404
Subtotal	**$4,669**	**$4,943**

TABLE 21B. SITE SUPPLIES—NONDURABLE ITEMS

Item	Total cost (USD)	
	Okongo (16 sites)	Eenhana (18 sites)
Urine test—glass	$1,000	$1,059
Kidney dish (emesis basin)	$994	$1,052
Thermometer	$736	$779
Tape measure	$176	$186
Bucket	$201	$213
Wash basin	$214	$226
Stethoscope	$141	$150
Ear/nose/throat kit	$1,478	$1,565
Fetoscope	$1,055	$1,117
Blood pressure monitor	$833	$882
Subtotal	**$6,829**	**$7,230**

LABOR

We compiled labor costs based on the composition, current salaries, and actual hours worked of the health teams providing C-BART services. Total labor costs for C-BART were estimated at 57,157 USD; in Okongo, the costs were estimated to be 23,347 USD, and in Eenhana, 33,810 USD. Tables 22a and 22b provide a breakdown of those costs by district.

TABLE 22A. LABOR COSTS—OKONGO DISTRICT

Position	Total C-BART hours	Hourly salary (USD)	Total salary costs for C-BART (USD)
Nurse	499	$21.04	$10,501
Pharmacist assistant	499	$11.86	$5,917
Health assistant	499	$4.05	$2,017
Driver	499	$2.02	$1,010
Administrative officer (data clerk)	499	$7.82	$3,900
Total			**$23,347**

TABLE 22B. LABOR COSTS—EENHANA DISTRICT

Position	Total C-BART hours	Hourly salary (USD)	Total salary costs for C-BART (USD)
Nurse	1,311	$21.04	$27,589
Pharmacist assistant	347	$11.86	$4,115
Health assistant	347	$4.05	$1,404
Driver	347	$2.02	$702
Administrative officer (data clerk)	N/A	N/A	N/A
Total			**$33,810**

N/A = not applicable.

The costs above are focused only on those staff doing direct service delivery, and do not include any costs associated with HEWs or volunteers who make home visits to patients who miss appointments.

TRAVEL/TRANSPORTATION

Total travel/transportation costs were estimated at 2,762 USD. Of this amount, approximately 53% was related to vehicle fuel consumption. Table 23a breaks down the costs of fuel, based on total distance traveled between sites, the current price of fuel of 10.99 NAD per liter, and average fuel consumption of 10 km per liter.

TABLE 23A. TRAVEL/TRANSPORTATION—FUEL COSTS

Item	Okongo	Eenhana
Cost of fuel per liter (NAD)	$10.99	$10.99
Fuel consumption (km per liter)	10	10
Cost of fuel per km (NAD)	$1.10	$1.10
Cost of fuel per km (USD)	$0.09	$0.09
Total distance traveled to C-BART sites (km)	5,988	10,394
Total fuel cost (USD)	**$533**	**$925**

The remainder of travel and transportation costs relate to vehicle maintenance and registration. Table 23b breaks down these costs in detail.

TABLE 23B. TRAVEL/TRANSPORTATION—OTHER RECURRENT COSTS (USD)

Item	Okongo	Eenhana
Vehicle license/registration fee	$105	$65
Maintenance of tires	$243	$243
General vehicle maintenance	$324	$324
Total cost	**$672**	**$632**

MONITORING, SUPERVISION, AND REVIEW

C-BART received supervision visits once a year from regional clinical mentors or members of the District Coordination Committee. The only costs associated with these supervision visits were those related to vehicle fuel.

Assuming an average round-trip distance of 100 km per visit, an average cost of fuel of 10.99 NAD per liter, and fuel consumption of 10 km per liter, we estimated the cost for supervision of 311 USD, or 151 USD and 160 USD for Okongo and Eenhana, respectively.

Additionally, there were some minor one-time costs—again, specifically for fuel consumption—for exchange visits that took place between sites in different districts. The visits were conducted for new sites to learn about the processes and good practices from old sites. These costs were estimated at 36 USD, or 17 USD and 19 USD for Okongo and Eenhana, respectively.

TOTAL COSTS, COST PER SITE, AND COST PER CLIENT

Total costs across all categories are summarized in Table 24, disaggregated by district. Total C-BART costs for the one-year period were estimated at 93,736 USD, or 40,980 USD in Okongo and 52,756 USD in Eenhana. This translates to an annual per-site cost of 2,561 USD in Okongo (16 sites) and 2,931 USD in Eenhana (18 sites).

TABLE 24. TOTAL COSTS AND COST PER SITE (USD)

Cost category	Okongo	Eenhana	Total	% of total costs
Capital costs	$4,761	$5,038	$9,799	10.5%
Clinical/site supplies	$11,498	$12,174	$23,672	25.3%
Labor	$23,347	$33,810	$57,157	61.0%
Travel/transportation	$1,205	$1,556	$2,761	2.9%
Monitoring/supervision/review	$168	$179	$347	0.4%
Total	**$40,980**	**$52,756**	**$93,736**	**100%**
# C-BART sites	16	18		
Total cost per C-BART site	**$2,561**	**$2,931**		

Labor is the most significant cost component, at approximately 61% of total costs. The biggest difference between the districts was in this category, given the greater number of nurses in the composition of Eenhana's C-BART health team. Task shifting of certain services to lay cadres, junior volunteers, and expert patients is an important consideration for any strategy involving decentralized service delivery to stable ART patients, and the difference between the two districts is a reminder that the choice of cadre involved in providing C-BART services has a major impact on overall costs.

We also calculated the cost per C-BART patient, based on the number of C-BART patients seen at the sites in Okongo and Eenhana. Overall annual costs were estimated at 63.90 USD per patient, or 58.54 USD in Okongo and 68.78 USD in Eenhana. These costs are summarized in Table 25.

TABLE 25. ANNUAL COST PER C-BART PATIENT (USD)

Item	Okongo	Eenhana	Total
Total costs	$40,980	$52,756	$93,736
Total patients	700	767	1,467
Cost per C-BART patient	**$58.54**	**$68.78**	**$63.90**

4.4 DISCUSSION

There are limited costing data in the published literature on the resources required to scale up community-based ART distribution, and it is hoped that this analysis helps to contribute to that pool of costing data. Some studies, however, may yield useful benchmark estimates against which to weigh the cost per C-BART patient estimated in this analysis.

Vu and colleagues estimated the annual costs of three different models for differentiated ART service delivery in Uganda [43]. The authors estimated an average of 331 USD in annual per-patient costs across the three models, including the cost of ARV drugs. The purchase of ARV drugs and other medicines was approximately 60% of those costs, so if we exclude those costs to make a more direct comparison with the cost analysis of C-BART in Namibia, the results from the Uganda study are 131 USD per client per year. While there could be many differences between the types of costs included or excluded, and obviously different implementation contexts in Uganda and Namibia, using this benchmark suggests that the C-BART costs in Namibia look reasonable.

Another study in Uganda focused on costing a home-based ART initiation and mobile ART refill program, estimating the annual per-patient cost to be 304 USD, of which medications made up 41% [44]. Excluding medications, the annual cost per patient was 179 USD, which again makes the C-BART implementation costs in Okongo and Eenhana Districts seem economical. In addition, a three-armed, randomized trial currently underway in Zimbabwe will assess the cost-effectiveness of three- and six-month community-based ART refills, and will seek to estimate the average provider cost per patient [45]. These data, once available, will be valuable for benchmarking the costs of C-BART in Namibia.

In the context of differentiated ART service delivery in Namibia, it is also very important to study the impact on facility-level workload, based on the reduced number of clients being served, since this is a critical component of the potential cost savings that could result from C-BART. One study looking at the prospects for differentiated HIV care across 38 countries estimated that up to 46% fewer full-time-equivalent HCWs could be needed by 2020 due to the implementation of differentiated care, as compared with undifferentiated care [46]. If we also factor in the increased retention on treatment and better patient outcomes that result from a decentralized model, there would likely also be a reduction in costs due to hospitalizations averted.

Furthermore, an often overlooked area is that of patient-level costs. Community-based ART models likely result in significant savings in patient time and money (not only out-of-pocket travel costs, but travel and waiting time, which results in forgone wages). The Zimbabwe study cited above collects patient-level cost data [45], and it would be valuable to collect these data in Okongo and Eenhana Districts as well, if feasible, to give a more complete picture of the costs associated with implementing C-BART. Patient-level cost savings could potentially offset some of the C-BART implementation costs.

LIMITATIONS

A challenge in capturing the resources needed and their costs was the availability and quality of documentation. In addition, the retrospective estimation of the time spent by program staff on the C-BART activities may not be as accurate as if these data were captured prospectively. We worked closely with MoHSS staff to identify the necessary documents and triangulate the data to assure validity.

4.5 CONCLUSIONS

Based on our analysis, the total costs to implement C-BART in Okongo and Eenhana Districts of Namibia seem reasonable when considering the reduced burden at the health facility and reduced costs to patients in the form of lower transportation costs and less waiting and travel time, and given the limited number of benchmarks available in the literature. These costing data may facilitate policymakers' budgeting and planning for resourcing the response to the HIV epidemic, and potentially scaling up the C-BART model across Namibia. Finally, any discussion around the total costs to implement C-BART must also keep in mind the potentially large cost savings to be realized from a reduced burden on health facilities and in the form of savings to patients and caregivers.

5. OVERALL CONCLUSIONS AND RECOMMENDATIONS

Overall, C-BART is a well-accepted program that, in partnership with the community, has been effective in improving patient retention, ART adherence, and viral suppression. Its costs appear to be reasonable, and cost savings may have been realized through both a reduced patient burden on the health facility and a reduced cost burden on the patients. We offer the following recommendations:

1. Reassess the criterion of six-month stability on ART for down-referral. Evaluation results indicate that this criterion could be shortened or eliminated with limited negative effects on patient clinical outcomes.

2. Review global evidence on pediatric ART adherence and triangulate it with routine data on pediatric C-BART patients. Explore how pediatric ART adherence could be improved in C-BART by examining program, facility, and patient factors that affect adherence, providing targeted HCW training, and reviewing how pediatric patients are managed and how often visits should occur among the different age groups.

3. Further analyze factors associated with C-BART patient deaths, including cause of death. In particular, examine reasons why the majority of patients who died had clinic visits within three months of death, as well as the reasons for more deaths among males than females. This examination should include a review of the processes for identifying patients who may be failing ART and transitioning them to second- or third-line regimens. Also, explore whether targeted efforts to encourage men to initiate ART earlier may be needed.

4. Consider formalizing the C-BART program through developing (1) a manual of operations and standard operating procedures to standardize activities, (2) improved patient tracking and down- and up-referral systems, and (3) a specific C-BART training program for HCWs and HEWs. The formalization of the program could also include integration of comprehensive HIV and primary health care services.

5. Consider conducting a study to estimate the annual per capita costs of facility-based ART care. This information could then be compared with C-BART costs to inform planning and potential scale-up of the C-BART program.

6. Consider expanding the C-BART program to similar rural settings in Namibia.

7. Continue to develop unique patient identifiers to ensure that each patient has one unique identity within the health system, and consider introducing one electronic medical record system to be used at all points of care. Such a system would facilitate development of longitudinal medical records and allow users of services to be tracked across the health care sector. Ensure that the NIP requisition forms capture the patient's unique ART number for upload into the MEDITECH system.

8. Mobilize resources to provide privacy at the C-BART sites.

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APPENDIXES

APPENDIX 1: C-BART EVALUATION STUDY TEAM

TABLE A1. STUDY TEAM MEMBERS

Organization	Name	Title	Email
MoHSS			
MoHSS–DSP	Ndapewa Hamunime, MD	Chief Medical Officer, HIV and STI Program	hamunimen@NACOP.NET
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MoHSS–Okongo	Julia Nghifikwa	Data Clerk	Julianghifikwa1@gmail.com
MoHSS–Eenhana	Mike Kudumo	Monitoring & Evaluation Officer	
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DELTA = DELIVERING TECHNICAL ASSISTANCE; DGHT = DIVISION OF GLOBAL HIV & TB; DSP = DIRECTORATE OF SPECIAL PROGRAMMES; HMIS = HEALTH MANAGEMENT INFORMATION SYSTEM.

APPENDIX 2: EVALUATION SITES

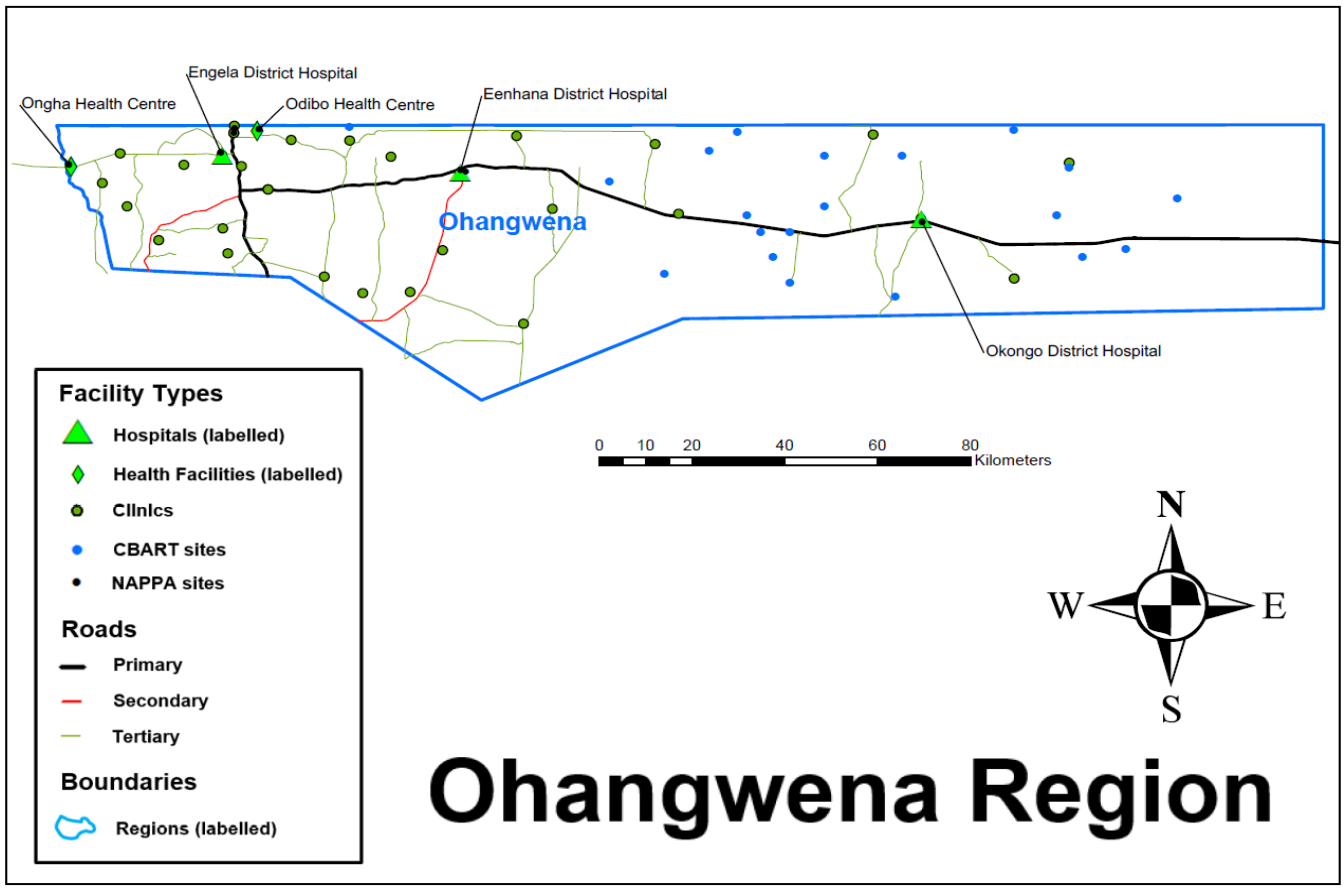
TABLE A2. C-BART SITES IN OKONGO AND EENHANA DISTRICTS

Main Facility Site	C-BART	Year Established
Okongo District		
Okongo District Hospital—ART Clinic	Onehanga	2007
	Olupale	2010
	Omauni	2008
	Onghalulu	2008
	Oshitishiwa	2007
	Oupili	2007
	Oshifitu	2007
	Omutwewomunhu	2007
	Onamihonga	2007
	Efinde	2013
	Odila	2015
	Okatope	2014
	Oshilambwili	2016
	Oshalumbu	2007
	Enyana	2017

Main Facility Site	C-BART	Year Established
	Eendombe	2017
Eenhana District		
Eenhana District Hospital—ART Clinic	Onaimbungu	2017
	Oshuuli	2016
NIMART Clinics:	Onambaladi	2016
Oshikunde	Onhunda	2016
Epembe	Onduludia	2016
Oshandi	Oheti	2016
Omundaungilo	Okanaimbula	2016
Omuhongo	Omutwewondjamba	2016
Oshaango	Ondwi	2016
Onambutu	Ehenene	2017
Ongula Yanetanga	Eshii	2017
	Ombwa	2017
	Onaisati	2017
	Otunganga	2017
	Omatha	2017
	Uukango	2017
	Oshangu	2017
	Etyapa	2017

APPENDIX 3: GEOGRAPHIC LOCATIONS OF C-BARTS SITES IN OKONGO AND EENHANA DISTRICTS

FIGURE A1. MAP OF OHANGWENA REGION



NAPPA = Namibia Planned Parenthood Association.

APPENDIX 4: LINKAGE OF DATA, DEDUPLICATION OF RECORDS, AND DATA QUALITY AND VERIFICATION

LINKAGE OF DATA

For identified C-BART patients, we used the following linking variables to match ePMS patients with their EDT records: unique ART number, last name, first name, gender, DOB, and date of ART initiation. Because the MEDITECH database did not contain the unique ART number, we used only the last name, first name, gender, and DOB variables to link the ePMS and MEDITECH records. Linking of ePMS to EDT records was performed in three iterations, whereby patients linked in one iteration were excluded from subsequent iterations:

(1) By unique ART number
(2) By first name–last name–DOB–gender identifier
(3) By probabilistic record linkage (PRL) using CDC Link Plus software, then by manually checking matches by making a subjective decision about whether the match was true

The ePMS database was independently linked to the MEDITECH database using only the latter two iterations because the MEDITECH database did not contain the unique ART number.

ITERATION 1: MATCHING BY UNIQUE ART NUMBER

All patients have a unique ART number in the ePMS database. This number is partially available in the EDT database but not available in the MEDITECH database.

ITERATION 2: MATCHING BY AN ID CREATED FROM PATIENT DEMOGRAPHICS

Variables used were first name, last name, DOB, and gender. For example, Susan Brooke, born on 3 December 1984, whose gender is Female, had a value for the nameID variable of susbro30753f. In this case, 30753 is the Excel serial date number of the patient's DOB (January 1, 1900, is serial number 1).

ITERATION 3: PROBABILISTIC RECORD LINKAGE AND MANUAL CHECKING/EYEBALLING LINKAGE

For those records that remained unmatched after the above two methods, we used PRL matching along with manual checking and visually reviewing the data. The PRL software generates a list of records that it has matched, along with linkage scores for each record pair that has been found to be matched to some extent (based on a threshold set by the user). A relatively high linkage score (e.g., > 10) means that there is relatively more evidence (probability) that the two records belong to the same patient. We used a relatively low linkage score threshold of 7 (compared with the software-recommended default value of 10) to define a true match for each record pair. We used a score of 7 because the candidate data set for probabilistic matching was composed of records that were left unmatched after the first two iterations (by the other linkage methods). Thus, the unmatched data left for PRL in the third iteration included records that had differences in names, spellings, DOBs, and genders between the two databases.

The results of PRL matching are not definite. After performing PRL on the data, we reviewed all "matched" records to determine final matches based on first name, last name, DOB, gender, and for ePMS−EDT, date the patient started ART. Thus, we manually compared the pair of records for each match defined by the software to decide through visual examination if there was enough concordance on the linking variables to approve the match. On the list of linked records (the results from PRL matching), we flagged the records that we deemed a true match through visual examination and added these matches to those from the first two iterations.

DEDUPLICATION OF PATIENT RECORDS IN THE COMPOSITE DATABASE

Because duplicate records by unique ART number were retained during linking of the data in the three electronic databases, the final composite database contained duplicate patients. We compared the ePMS demographic information for each of the duplicates identified and confirmed all variables to be exactly the same in each of the records. We reviewed follow-up clinic data with the duplicate demographic data to create a single complete follow-up history for the patient. The original composite database contained 1,504 records, including 71 duplicate records for 34 patients. After deduplication and exclusion of 71 duplicate records, and inclusion of 34 nonduplicate records, we obtained a sample of 1,467 C-BART patients.

Of the 1,467 patients identified as C-BART patients in ePMS, 69% had a matching EDT record and 63% had matching VL test results in MEDITECH, leading to a 46% overall match rate among all three databases (Table A3). Among the C-BART sites, Okongo District had higher match proportions overall.

TABLE A3. RECORD MATCHES ACROSS THE THREE DATABASES—EPMS, EDT, AND MEDITECH—OVERALL AND BY TYPE OF PATIENT, OKONGO C-BART, EENHANA C-BART, AND EENHANA NIMART/C-BART (N = 1,467)

Type of patient	ePMS-EDT matches *n* (%)	ePMS-MEDITECH matches *n* (%)	ePMS-EDT-MEDITECH matches *n* (%)
Okongo C-BART	567/700 (81%)	447/700 (64%)	390/700 (56%)
Eenhana C-BART	136/197 (69%)	118/197 (60%)	93/197 (47%)
Eenhana NIMART/C-BART	315/570 (55%)	362/570 (64%)	199/570 (35%)
All	1,018/1,467 (69%)	927/1,467 (63%)	682/1,467 (46%)

DATA QUALITY AND VERIFICATION

To assess the quality of the ePMS data, we randomly selected 90 patients from the study data set. At a site visit to Okongo and Eenhana Districts in April 2018, we located the PCBs for the selected patients, abstracted their data for seven key variables (unique ART number, sex, DOB, ART start date, date enrolled in care, date of last visit, and latest ART regimen), and entered these data into the database. We then calculated the percentage of agreement between the PCB and ePMS data. Agreement between the PCB and ePMS data was ≥ 90% for all variables except date of last visit and latest ART regimen (Table A4). Agreement on the date of last visit was 53% (48/90) overall, with a lower percentage for all Eenhana sites (35%, 19/55) than for Okongo (83%, 29/35). Agreement on last ART regimen was 84% overall, with 100% agreement in Okongo but only 74% (40/54) in Eenhana.

TABLE A4. VALIDATION OF EPMS, EPMS-EDT MATCHES, AND EPMS-MEDITECH MATCHES IN STUDY DATABASE (90/1,467 RANDOMLY SELECTED PATIENTS)

Variable	All patients[a] *n/N* (%)	Okongo	Eenhana	
		C-BART *n/N* (%)	C-BART *n/N* (%)	NIMART/C-BART *n/N* (%)
Unique ART number[b]	90/90 (100%)	35/35 (100%)	17/17 (100%)	38/38 (100%)
Sex[b]	84/89 (94%)	33/34 (97%)	15/17 (88%)	36/38 (95%)
DOB[b]	82/90 (91%)	31/35 (89%)	16/17 (94%)	35/38 (92%)
Date ART started[b]	79/87 (91%)	32/34 (94%)	13/15 (87%)	34/38 (89%)
Date enrolled in care[b]	77/86 (90%)	32/33 (97%)	1517 (88%)	30/36 (83%)
Date of last visit[b]	48/90 (53%)	29/35 (83%)	8/17 (47%)	11/38 (29%)
Latest ART regimen[b]	75/89 (84%)	35/35 (100%)	11/17 (65%)	29/37 (78%)
EDT number[c]	48/75 (64%)	37/41 (90%)	9/12 (75%)	2/22 (9%)
VL date/result[d]	25/50 (50%)	14/21 (58%)	5/17 (29%)	6/22 (27%)

[a] *Denominators vary due to missing data.*

[b] *ePMS matches—variable abstracted from the PCB was in agreement with the variable abstracted from ePMS in the study database.*

[c] *ePMS-EDT matches—EDT number abstracted from the PCB/electronic pharmacy records was in agreement with the EDT number in the study database.*

[d] *ePMS-MEDITECH matches—last VL date/result recorded in the PCB agreed with a VL date/result in the study database.*

We also validated the ePMS-EDT matches and ePMS-MEDITECH matches. A true ePMS-EDT match was defined as agreement between the EDT number from the PCB and the EDT number in the study database. Similarly, a true ePMS-MEDITECH match was defined agreement of the last VL date/result from the PCB with a VL date/result in the study database.

Overall, the ePMS-EDT match was 64% (48/75)—90% (37/41) among Okongo patients but only 32% (11/34) for Eenhana, with NIMART/C-BART patients having an especially low percentage of matches (9%). The ePMS-MEDITECH match was 50% (25/50) overall, 58% (14/21) for Okongo, and 28% (11/39) for Eenhana. Because these match rates were unacceptably low, potentially biasing the results of the patient outcome analyses, we carried out a data verification exercise in September 2018 in which the EDT number, the most recent VL date/result, and the date of down-referral were updated/abstracted using available medical records for all C-BART patients in the study data set. For each patient, we updated/abstracted the pharmacy number from the EDT and entered it into the ePMS at the Okongo and Eenhana sites. We also abstracted the most recent VL test result by searching the districts' ePMS databases, the PCBs, MEDITECH databases, or the patients' health passports. We also abstracted the date of down-referral from the PCB or patient's health passport, and attempted to find any instances of up-referral for patients who may have needed care at the referring health facility for any reason.