Effectiveness evaluation of first phase integrated chronic care model to improve prevention, care and support for people living with HIV in Côte d'Ivoire

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Note to readers

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Summary:

Background

The leading cause of death in Côte d'Ivoire is HIV; the country had an estimated HIV prevalence rate of 3.5% for adults 15-49 years of age in 2015, the highest in francophone West Africa. However, in 2015 only 35% of PLHIV were receiving ART, and less than half were receiving treatment according to national guidelines at that time (CD4<350mm^3). We are piloting an intervention to improve client enrolment in HIV care and long-term retention to ART that includes the following core components: 1) a proactive team approach to care; 2) care focused on the client with a strong long-term provider/client relationship; 3) seamless referral systems; 4) task shifting to enable care as close to the client as possible; and 5) improved community/health facility linkages.

Methods

This evaluation is a mixed-methods study with quasi-experimental, difference-in-difference, propensity score matching, and pre-test post-test study design comparing outcome measures in intervention sites in one region of Côte d'Ivoire with matched comparison sites in a neighbouring region. The model was developed in 2014-2015, facility preparation began in August 2015, and implementation of core aspects began in February 2016. Data collection took place between August 2015 and August 2016. Quantitative data were collected from client records and pharmacy registers. Qualitative and costing data were collected through interviews and phone surveys, respectively. All data were then analysed to determine effectiveness, acceptability and cost-effectiveness of the first phase of this integrated chronic care model for patients living with HIV in Côte d'Ivoire on adherence and retention to treatment using SAS for quantitative analyses, Atlas-ti 7.5 for qualitative analyses, and SPSS for cost-effectiveness analyses.

Results

Quantitative data analysed for this report covers cohorts of patients that began treatment between 1 January 2013 and 30 June 2016. In this quasi-experimental study, we conducted a difference-in-difference analysis and propensity score matching to evaluate the intervention impact between the intervention region and the comparison region. Pharmacy registry data and clinical follow-up data suggest that the intervention region N'Zi-Iffou improved relative to Indénie-Djuablin. In many cases it was not statistically significant or consistent. However, in difference-in-difference multivariable models controlling for regional imbalances at baseline, we found a significant interaction between initial CD4 count and intervention status, in that the intervention region showed substantially and significantly better retention than the control region among clients with a higher initial CD4 count. In analyses of propensity score matched datasets, we did not observe significant differences in 30-day, 90-day, or 180-day retention between the two regions. Overall, both the quantitative clinical and pharmacy records data showed that retention in both regions was steadily improving during the study period. Our ability to assess the impact of the intervention will be greater after a longer follow-up period.

Qualitative data suggested that enablers to adherence to ART at service-level included facilitating access to medications; providers following up with clients; counseling emphasizing HIV as a chronic condition; confidentiality; clinical care teams and scheduling

appointments; and encouragement of social support and partner disclosure of HIV status. Barriers to adherence were mainly at the client-level, including difficulty in HIV disclosure and stigma, being seen at the health facility by others in the community; the need to skip appointments due to social responsibilities; limited ability to pay for roundtrip transport costs to the clinic; and travel outside the region for work or social responsibilities. Service-related barriers were related to staffing and wait times. Overall, intervention site participants spoke more of the service-related enablers, while intervention and comparison site participants mentioned client-related barriers with similar intensity.

A total of 317 interviews were completed for the costing survey. Overall, 143 of 317 (45%) respondents reported incurring $0.00 cost for care-seeking. Amongst the 174 individuals that incurred a cost, the total mean cost was $6.03 while the median was $1.94. When considered across the population at large, median direct costs fall to $0.00 given the infrequency with which overall direct costs were reportedly incurred. The occurrence of indirect costs including transportation fees, wages lost, and/or payments to be seen first were observed in a large proportion of respondents.

Conclusions

Adherence to treatment as evaluated through pharmacy registry data is poor across all sites with an average of 22% 180-day cumulative adherence, which is of great concern as adherence to ART is critical to achieving viral load suppression. The quantitative study showed encouraging results in the difference-in-difference analysis, suggesting a significant impact of the intervention on 30-day retention. We also found that retention was higher in the intervention region at 30 days based on the propensity score matched analysis, although this finding was not significant. The qualitative study showed that stigma remains a great barrier to care for many clients, and that client-factors such as ability to reach the facility for services, remain a challenge even in a setting of free treatment for HIV. The cost analysis showed that 45% of patients reported not incurring any costs directly or indirectly associated with care seeking which highlights the effectiveness of efforts on the part of the Government of Côte d'Ivoire to expand access to critical HIV services, including drugs and clinical testing.

The CDC-funded project aims to address personal attitudes and beliefs, sociocultural norms, and patient self-efficacy through community support and focusing care of PLHIV on the clients themselves, rather than the healthcare system. One of the strengths of the evaluated chronic care model is that it was developed in full consultation with relevant stakeholders, most importantly the Ministry of Health. This has fostered ownership of the model by regional and district managers, those responsible for provision of services for the population, and will contribute to the sustainability of the model if it proves to be effective. Our ability to assess the impact of the intervention will be greater after a longer follow-up period of 18-24 months.

Keywords

HIV, ART, retention, adherence

Contents

Abbreviations and acronyms

ART	Antiretroviral therapy
ARV	Antiretroviral
CDC	Centers for Disease Control and Prevention
CEA	Cost Effectiveness Analysis
CHR	Regional Hospital (Centre Hôpital Régional)
CHW	Community health worker
CNER	Ethical review board (Centre National d'Éthique et de la Recherche)
CSU	Urban health centre (Centre de Santé Urbain)
FGD	Focused group discussion
FP	Family planning
HG	General Hospital (Hôpital General)
ICC	Intraclass correlation coefficient
IDI	In-depth Interview
JHBSPH	Johns Hopkins Bloomberg School of Public Health
LTFU	Loss/lost to follow up
MOH	Ministry of Health
MUSC	Medical University of South Carolina
OCR	Optical Character Recognition
PLHIV	Person/people living with HIV
PMTCT	Prevention of mother to child transmission (of HIV)
RCT	Randomized control trial
SCI-VIH	Integrated Chronic Care – HIV
sIMB	Situated, Information, Motivation and Behavioural Skills
STI	Sexually transmitted infection
TB	Tuberculosis
VCT	Voluntary Counselling and Testing
WHO	World Health Organisation

1. Introduction

In June 2016, globally there were 18.2 million people living with HIV (PLHIV) on antiretroviral therapy (ART), demonstrating the remarkable progress that has been made in the past 15 years; however, there are an estimated 36.7 million PLHIV globally, meaning that more than 50% of people living with this treatable, infectious, chronic disease are not receiving treatment.[1]

Côte d'Ivoire is a country in West Africa with a population approaching 23 million, a life expectancy at birth of 51 years, and robust economic growth. Forty percent of the population lives in the two lowest wealth brackets.[2] In 2015 the leading cause of death was HIV, and the country had an estimated HIV prevalence rate of 3.5% for adults 15-49 years of age.[3,4,5] A fundamental component to ending the AIDS epidemic is to ensure that PLHIV are diagnosed, afforded lifelong treatment, and provided adherence support to remain engaged in care and retained on treatment for life.

In September 2013, Jhpiego received funding from the United States Centers for Disease Control and Prevention (CDC) to design and implement an integrated model of chronic care for PLHIV. The goal of this five-year $5 million project titled *"Soins Chronique Integres-VIH"* or "Integrated Chronic Care – HIV" (SCI-VIH) is to assist the Ministry of Health (*Ministère de la Santé et de l'Hygiene Publique)* to improve client enrolment in HIV care and long-term retention to ART.

The primary objectives of the SCI-VIH project are to develop a context-specific, integrated chronic care model; roll out the model in two regions of Côte d'Ivoire; evaluate the model; and support the government to scale up the model. This information is expected to provide evidence to decision-makers on how to optimize HIV outcomes and will be hugely important for advancing the health policy discussion within Côte d'Ivoire, specifically related to revising service delivery guidelines to improve integration of health services and related standards and protocols (e.g., minimum package of care for primary health care, complementary package of care of secondary and tertiary care, nationally adopted guidelines and tools for service delivery).

Few rigorous impact evaluations have directly tested the introduction of an integrated service

[1] UNAIDS, 2016. AIDS by the numbers: AIDS is not over, but it can be.
Retrieved from http://www.unaids.org/sites/default/files/media_asset/AIDS-by-the-numbers-2016_en.pdf
[2] Institut National de la Statistique (INS) and ICF International. (2012). Enquête Démographique et de Santé et à Indicateurs Multiples de Côte d'Ivoire 2011-2012. Calverton, Maryland, USA:
[3] World Bank, 2016. Retrieved from: http://data.worldbank.org/country/cote-divoire
[4] *Global Burden of Disease*. (2015). Retrieved from: http://vizhub.healthdata.org/gbd-compare/
[5] UNAIDS, 2016. Côte d'Ivoire HIV and AIDS estimates (2015).
Retrieved from http://www.unaids.org/en/regionscountries/countries/ctedivoire

model as a public health intervention.[6,7,8] Furthermore, no rigorous study has yet evaluated the effects of integration of HIV services into primary health care on retention to HIV care and treatment specifically.[9]

In January 2015, 3ie funded Jhpiego and collaborating partners Medical University of South Carolina (MUSC) and Johns Hopkins Bloomberg School of Public Health, to conduct an evaluation to determine the effectiveness, acceptability and cost-effectiveness of the first phase of this integrated chronic care model for patients living with HIV in Côte d'Ivoire on adherence and retention to care and treatment, based upon a Theory of Change (Figure 2). The two-arm, mixed-method study uses multiple data sources for quantitative, qualitative, and cost analysis-specific hypotheses:

Quantitative:

Comparing intervention and comparison groups, quantitatively measure retention and adherence; we used a difference-in-difference analysis and propensity score matching to compare intervention vs. comparison region and determine whether implementation of the integrated chronic care model results in:

1. an increased rate of retention in care at 30, 60, 90 and 180 days among people living with HIV (PLHIV)?

2. an increased rate of adherence to treatment among PLHIV on ART, defined as percent of days covered with treatment, collection of ARVs within 3 days of need for refill based on number of pills previously dispensed, and clinical appointment attendance within defined time period based upon time since ART initiated?

Qualitative:

Assess provider and client acceptability and perceived effectiveness of the integrated chronic care model to reducing barriers and improving enablers affecting ART clients' adherence to

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[6] Heard, A, Peterson, K, Modi, S, Esper, H, Calvo, F, & Brown, AN, 2014. *Integrating HIV Service with Other Health Services to Improve Linkage to Care, Retention, and Adherence: A Scoping Report.* Retrieved from http://www.3ieimpact.org/media/filer_public/2014/07/15/integration_of_hiv_services_scoping_report_07111-final.pdf

[7] Greig, J, O'Brien, D, Ford, N, Spelman, T, Sabapathy, K, & Shanks, L, 2012. Similar mortality and reduced loss to follow-up in integrated compared with vertical programs providing antiretroviral treatment in sub-Saharan Africa. *J Acquir Immune Defic Syndr*(59(5)), e92–e98. doi:10.1097/QAI.0b013e31824206c7

[8] Church, K, & Mayhew, S, 2009. Integration of STI and HIV prevention, care, and treatment into family planning services: a review of the literature. *Studies in Family Planning*(40(3)), 171–186.

[9] Heard, A, Peterson, K, Modi, S, Esper, H, Calvo, F, & Brown, AN, 2014. *Integrating HIV Service with Other Health Services to Improve Linkage to Care, Retention, and Adherence: A Scoping Report.* Retrieved from http://www.3ieimpact.org/media/filer_public/2014/07/15/integration_of_hiv_services_scoping_report_07111-final.pdf

scheduling of clinic visits and retention in treatment, through in-depth interviews and focus groups. The specific questions for the qualitative assessment were as follows:

1. What are enablers and barriers to retention in care and adherence to HIV treatment that are service and client-related, and do these vary for intervention and control sites?

2. How is HIV care and treatment coordinated and integrated with other health services, and do these vary for intervention and control sites?

3. What are client recommendations to improve HIV service delivery and retention in care?

Economic costs to PLHIV:

To determine the incremental cost-effectiveness of an integrated chronic care model for patients living with HIV as compared to existing care in 16 health facilities in Côte d'Ivoire over a six-month period.

2. Background/Context

Côte d'Ivoire

Despite relative success in decreasing the rates of new HIV infections and AIDS-related deaths throughout sub-Saharan Africa, many PLHIV are not receiving the ART they need in order to live long and healthy lives.[10] Côte d'Ivoire has the highest rate of adult HIV prevalence in francophone West Africa (3.5%); however, in 2015 only 35% of PLHIV were receiving ART, and less than half were receiving treatment according to national protocols at that time ($CD4<350mm^3$).[11,12] The fundamental goal of ART is to reduce HIV-associated morbidity and mortality through inhibiting replication of HIV. The results of HPTN052 confirmed years of clinical evidence that ART decreases transmission of HIV. This randomized, controlled, multi-centre trial demonstrated that ART is highly effective and prevents transmission of HIV when taken until viral suppression is achieved. High rates of attrition during treatment, especially in the initial period following diagnosis, has been recognized as a key barrier to increasing the number of PLHIV on lifelong treatment.[13,14] Program reports from Côte d'Ivoire in 2012 revealed

[10]UNAIDS, 2013. *Global Report: UNAIDS Report on the Global AIDS Epidemic 2013*. Retrieved from http://www.unaids.org/en/media/unaids/contentassets/documents/epidemiology/2013/gr2013/UNAIDS_Global_Report_2013_en.pdf

[11] Institut National de la Statistique (INS) and ICF International, 2012. *Enquête Démographique et de Santé et à Indicateurs Multiples de Côte d'Ivoire 2011-2012*. Calverton, Maryland, USA

[12] World Health Organization, 2013. *Global Update on HIV Treatment 2013: Results, Impact and Opportunities (June)*. Retrieved from http://apps.who.int/iris/bitstream/10665/85326/1/9789241505734_eng.pdf

[13] Gardner, EM., McLees, MP., Steiner, JF., Del Rio, C, & Burman, WJ, 2011. The spectrum of engagement in HIV care and its relevance to test-and-treat strategies for prevention of HIV infection. *Clin Infect Dis, 52*(6), 793-800. doi:10.1093/cid/ciq243

[14] Mutasa-Apollo, T, Shiraishi, RW, Takarinda, KC, Dzangare, J, Mugurungi, O, Murungu, J, Woodfill, CJ, 2014. Patient retention, clinical outcomes and attrition-associated factors of HIV-infected patients

that only 67% of clients were known to be alive and on treatment 12 months after initiation of ART, indicating that there are significant challenges with retention.[15,16]

Considerable efforts have been made in the last few years to improve Côte d'Ivoire's national response to HIV/AIDS. The country is emerging from several years of socio-political crisis which negatively affected the HIV/AIDS prevention interventions.[17] Despite the difficulties related to this crisis, the country has made considerable advances in its ART program. In Côte d'Ivoire, HIV services are currently available at all levels of the government's health pyramid (tertiary, secondary, primary); however, they are not evenly or equitably distributed across the country. Early in Côte d'Ivoire's response to the epidemic, HIV services were verticalised, with clinical and laboratory services implemented in parallel to existing services. This is slowly changing, and while some gains have been made in "mainstreaming" HIV services to offer them at more health care service delivery sites (including rural health centres and dispensaries), current guidelines are erratically implemented, leaving a fragmented system with a lack of routine supervision and without appropriate referrals. For all practical purposes, HIV services are not integrated with other health service delivery platforms.[18,19]

In other countries, treating HIV as a chronic, lifelong disease and integrating HIV services with other health services has shown improvements in both enrolment and retention, as well as having positive impacts on client satisfaction.[20] Peer education, partner involvement and mobile-based support, i.e., SMS reminders have all demonstrated improved uptake and retention in care.[21,22]

The integrated chronic care model

The primary objectives of the CDC-funded project are to develop a context-specific, integrated chronic care model; roll out the model in two regions of Côte d'Ivoire; and support the

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enrolled in Zimbabwe's National Antiretroviral Therapy Programme, 2007-2010. *PLoS One, 9*(1), e86305. doi:10.1371/journal.pone.0086305

[15] *Resultats annuels PEPFAR CI FY 2013* (Presentation by URC)

[16] University Research Co., LLC. Rapport de Recherche Evaluation: Facteurs Influençant la Sortie des Patients Vivant avec le VIH du Circuit de Traitement en Côte d'Ivoire, Decembre 2013

[17] Conseil National de Lutte Contre le Sida, 2014. Suivi de la Déclaration de Politique sur le Sida de Juin 2011: Rapport National de la Cote d'Ivoire 2014.

[18] *Guide de Supervision du Système National de Santé Publique, Cote d'Ivoire*.

[19] Herlihy, JM., Hamomba, L., Bonawitz, R, Goggin, CE., Sambambi, K, Mwale, J, Thea, DM, 2015. Implementation and Operational Research: Integration of PMTCT and Antenatal Services Improves Combination Antiretroviral Therapy Uptake for HIV-Positive Pregnant Women in Southern Zambia: A Prototype for Option B+? *J Acquir Immune Defic Syndr, 70*(4), e123-129. doi:10.1097/qai.000000000000076

[20] Ndagijimana, A, Rugigana, E, Uwizeye, CB, & Ntaganira, J, 2015. One-stop TB-HIV services evaluation in Rwanda: comparison of the 2001-2005 and 2006-2010 cohorts. *Public Health Action, 5*(4), 209-213. doi:10.5588/pha.15.0093

[21] Ambia, J, & Mandala, J, 2016. A systematic review of interventions to improve prevention of mother-to-child HIV transmission service delivery and promote retention. *J Int AIDS Soc, 19*(1), 20309. doi:10.7448/ias.19.1.20309

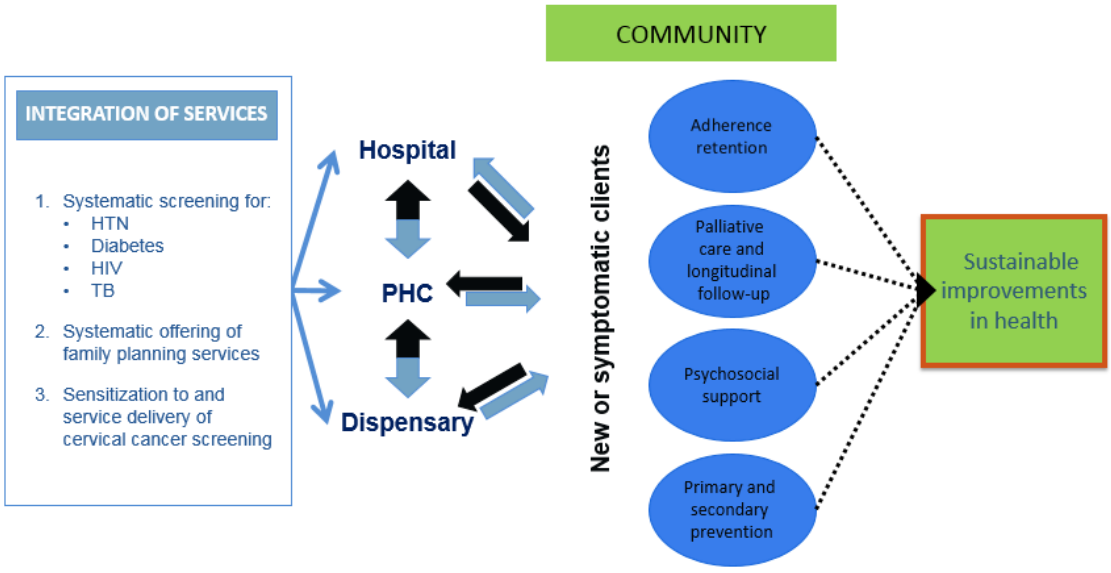
[22] Kanters, S, Park, JJ, Chan, K, Socias, ME, Ford, N, Forrest, JI, Mills, EJ, 2016. Interventions to improve adherence to antiretroviral therapy: a systematic review and network meta-analysis. *Lancet HIV*. doi:10.1016/s2352-3018(16)30206-5

government to scale up the model. The model's aim is to improve client enrolment and long-term retention in care in two regions of Côte d'Ivoire where Jhpiego is working closely with PEPFAR-partners and other relevant stakeholders to ensure coordinated care for PLHIV.

The model includes the following core components: 1) a proactive team approach to care; 2) care focused on the client with a strong long-term provider/client relationship; 3) seamless referral systems; 4) task shifting to enable care as close to the client as possible; and 5) improved community/health facility linkages. Figure 2 provides an overview of the Theory of Change, including the in-depth descriptions of the model components. The specific model components include: establishing patient care teams in the facilities; training nurses and midwives on prescription of ART: strengthening down referral, optimizing patient flow for people living with chronic diseases; standardizing use of appointment cards, and providing equipment to assist in management of other chronic diseases, i.e. glucometers and blood pressure cuffs; training community health workers on patient education; facilitating health club meetings; and supporting home visits.

The model looks at the health system holistically, recognizing the importance of all levels of care, with a particular focus on the referral system, both 'upwards' and 'downwards'. Historically referrals are made to facilities with more specialized services (from primary to district to tertiary), but the concept of 'down referral' for long-term care of people living with chronic diseases is new for Côte d'Ivoire (Figure 1).

Figure 1. Referral system focus of the model of care



Jhpiego's decades of work in health systems throughout sub-Saharan Africa have taught the organisation that integration is more than ensuring that several essential health services are available within a single health facility. Rather, integration is helping health care providers think about the needs of their client's first—offering as many services as possible within the level of care of the health care system to that client, regardless of their primary reason for seeking healthcare services.

The integrated chronic care model being evaluated was developed in close consultation with relevant national, regional, facility and community-level stakeholders. The model draws on holistic, systems-level models such as McLeroy's Socio-Ecological Model for Health Promotion, which focuses attention on both individual and social environmental factors as targets for health promotion interventions. Stender and Christensen's "Model of Primary Care Services Centering on the Interaction between the Primary Health Care Provider for a sub-Saharan African Country with High HIV, TB and Malaria Prevalence," also strongly informs Jhpiego's model; it emphasizes client-centred, family-focused care and health promotion. Implementation of the model is expected to result in individuals and families receiving ongoing care, as defined by their own needs, at each visit, with interpersonal, organizational, community and public policy factors addressed systematically.[23,24] By improving communication and linkages among the various levels and types of care within the tiered health system, always with the client at the centre, the intervention aims to streamline the client experience, reduce inefficiencies and breakdowns in the referral system, and improve client tracking and follow-up. At the policy level, the model illustrates how an integrated model for chronic care can improve service delivery by assisting managers and health care providers to operationalize and prioritize existing vertical, disease/condition-specific policies through a single integrated chronic care policy.

In addition to these broader, systems-level models, Jhpiego's approach draws on the principles of chronic HIV care, as outlined by the World Health Organization (WHO) in 2004.[25] In addition to the typical role of the provider to assess and treat, the principles of this model encourage providers to offer comprehensive services including empowering the client to self-manage his/her condition and seek ongoing care at the appropriate level of care (community, primary, secondary, tertiary). There is substantial evidence that chronic care approaches lead to better client outcomes: increased HIV testing of clients; enrolment in HIV care within three months of diagnosis; increased percentage of clients who remain in care (i.e., reduced loss to follow-up); and better medication adherence rates.[26,27]

Theory of Change:

As illustrated in Figure 2, the Theory of Change begins with program inputs:

- minimum package of integrated care
- decentralized care
- scheduling system

[23] McLeroy, KR, Bibeau, D, Steckler, A, & Glanz, K, 1988. An ecological perspective on health promotion programs. *Health Educ Q, 15*(4), 351-377.

[24] Stender, SC and Christensen, A, 2013. Patient-centered primary health care: synergy potential for health systems strengthening. *Int J Tuberc Lung Dis, 17*(10 Suppl 1), 15-21. doi:10.5588/ijtld.13.0356

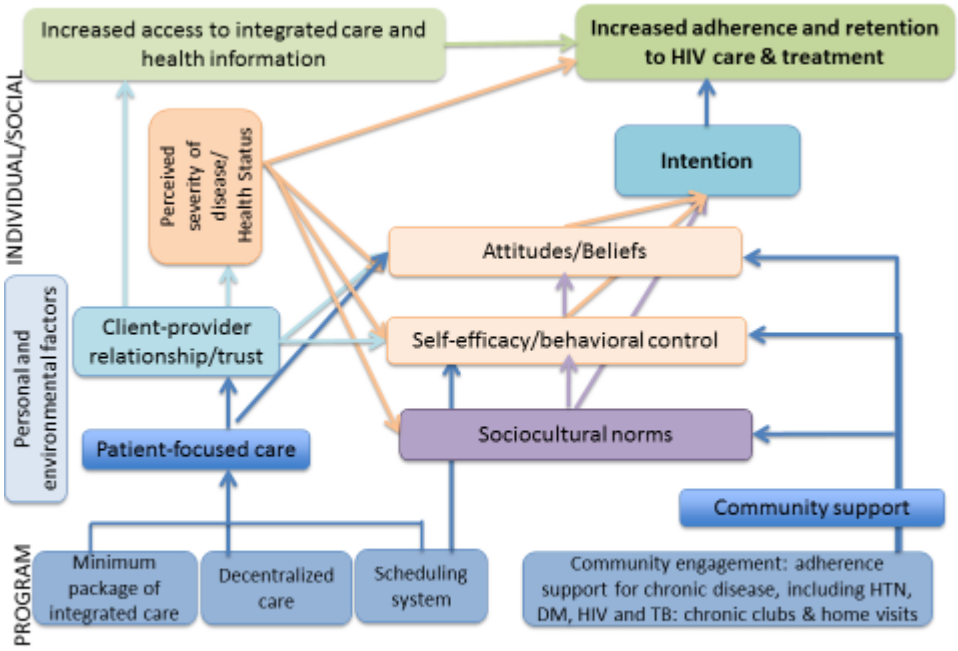
[25] World Health Organization, 2004. *Chronic HIV Care with ART Therapy and Prevention. IMAI/IMCI*. Retrieved from Geneva: http://www.who.int/3by5/publications/documents/chronCareModGenDraftRev1.pdf?ua=1

[26] Moore, RD, Keruly, JC, & Bartlett, JG, 2012. Improvement in the health of HIV-infected persons in care: reducing disparities. *Clin Infect Dis, 55*(9), 1242-1251. doi:10.1093/cid/cis654

[27] Wagner, EH, Austin, BT, Davis, C, Hindmarsh, M, Schaefer, J, & Bonomi, A, 2001. Improving chronic illness care: translating evidence into action. *Health Aff (Millwood), 20*(6), 64-78.

- community engagement through chronic clubs and home visits to provide psychosocial support for people living with HIV and/or other chronic diseases.

Figure 2: Theory of Change



These core program activities, implemented through the SCI-VIH project, ensure that a package of integrated services is available to all clients in intervention sites, which, in turn, will ensure that PLHIV who come to the health facility will receive these integrated services—or be seamlessly referred to a health facility that offers them. A primary goal of the project is to improve patient-centred care and community support. The focus on the patient and his/her family aims to improve the client-provider relationship. This, in addition to the community components, contributes to change in sociocultural norms, increased self-efficacy, and changes in attitudes and beliefs. This, in turn, contributes to improved health status, as does health seeking behaviour related to perceived severity of the disease and access to health information. Increased adherence and retention to HIV care and treatment are the expected outcome based on these inputs.

This theory of change, developed for the Jhpiego-supported CDC-funded programme and 3ie-funded evaluation, has been mapped to concepts of the Situated, Information, Motivation and Behavioural Skills (sIMB) Model and Andersen's Behavioural Model of Health Service Use.[28,29]

Table 1. Mapping of the integrated chronic care model

Integrated Chronic Care Model, Cote d'Ivoire Theory of Change (Stender et al, 2015)	sIMB construct for Retention in HIV Care (Smith L et al, 2012)	Andersen's Behavioral Model (ABM) of Health Service Use (Anderson, 1995)
Programme Related (Services)		
Coordinated Care: Patient Care Team; Minimum Integrated Package of Services & Appointment Scheduling and Patient Reminder	N/A	Health care environment: clinic factors & provider factors
Community-based adherence support: chronic clubs and home-visits		Health care environment: system factors
Client & Society Related		
Attitudes and Beliefs	Information	Perceived need (symptoms, health beliefs)
	Accurate Information	
	Misinformation	
	Cognitive Heuristics	
	Motivation	
	Personal Attitudes/Behaviour	
Perceived severity of disease	Perceived Vulnerability	
Attitudes and Beliefs	Competing Priorities	
Client-Provider relationship/trust	Patient-Provider Relationships	Health care environment: provider factors
Sociocultural norms	Social norms and support	Patient enabling & predisposing factors
Self-efficacy/ Behavioural Control	Behavioural Skills	
	Accessing ancillary services	
	Addressing practical barriers	
	Daily hassles/comorbidities	
	Planning reminder strategies	
	Obtaining social support	
Sociocultural norms (mentioned above)	Affective factors (stigma, feelings)	Patient predisposing factors (stigma included)
Health status (co-morbidities)	Co-occurring health and social/economic conditions	Patient predisposing factors (health status included)
Personal and Environmental Factors	Contextual	External Environment

[28] Smith, LR, Fisher, JD, Cunningham, CO, & Amico, KR, 2012. Understanding the behavioral determinants of retention in HIV care: a qualitative evaluation of a situated information, motivation, behavioral skills model of care initiation and maintenance. *AIDS Patient Care STDS, 26*(6), 344-355. doi:10.1089/apc.2011.0388

[29] Andersen, RM, 1995. Revisiting the behavioral model and access to medical care: does it matter? *J Health Soc Behav, 36*(1), 1-10.

Study Design & Timeline

This evaluation is a mixed-methods study with a quasi-experimental quantitative component employing a difference-in-difference analysis as well as propensity score matching to compare outcome measures in intervention sites in one region of Côte d'Ivoire versus matched comparison sites in a neighbouring region. The region selected for comparison was based upon geographical similarity, HIV prevalence and current PEPFAR implementing partner. Site selection for matching was based upon level of facility (hospital or health center), access to ART (% of clients ever started on ART and still on treatment), and whether or not TB diagnosis and treatment were available. The two regions were similar in many ways, but only one of the two regions was receiving the CDC-funded, Jhpiego-supported chronic care intervention. This provided an opportunity for a natural experiment, leading to our approach of using a difference-in-difference analysis controlling for factors imbalanced at baseline, as well as conducting propensity score matching to make a quasi-experimental assessment of the intervention impact.

Data collection for the study took place between August 2015 and August 2016. The project team began activities to scale up implementation of the chronic care model in September 2015; minimal implementation for impact was deemed to begin on 1 February 2016, given the complexity of the model and the phased implementation of the various components. Endline quantitative data collection occurred in August 2016, to allow for six months of implementation of components of the model from 1 February 2016 to 31 July 2016. However, it should be noted that adherence and retention data require longitudinal follow-up over time, therefore analysis only includes individuals who started ART before 30 June 2016 (the clinical records reviewed were those through 31 July 2016, therefore anyone who initiated ART in the month of July would not have even 30-day retention data available for analysis).

Table 2. Evaluation timeline

Component	Timeline
Quantitative Data Collection	August 2015
Qualitative Interviews and Focus Groups	May 2016
Patient Cost-Related Phone Survey	July-September 2016
Quantitative Endline Data Collection	August 2016
Data cleaning and analysis	June 2016 - ongoing

The primary quantitative outcome of interest was to determine whether implementation of the integrated chronic model of care had an effect on PLHIV retention to care and adherence to treatment. The objective of the qualitative component was to assess acceptability and perceived effectiveness of implementing the model, and the CEA analysis presents early findings on the economic consequences of ill-health.

Implementation of the model of care

The implementation of the project was started with a series of trainings and updates for clinical providers and community health workers (CHW) on the components of the model, which was the first step toward model implementation. For each project site, one clinician and at least two

community workers were trained on content applicable to their roles (including integrated management of chronic diseases, task shifting and mentoring, key messages on chronic diseases for home visits, etc.). Sixty-seven (67) clinical providers and 89 CHWs were trained. The project teams worked closely with District and Regional Health Management Teams to ensure ownership of activities. All providers were oriented to the model by end-February 2016, and specific training on integrated chronic care management, establishment of patient care teams and training/mentoring of nurses to prescribe ART was done in project facilities based on the role of clinical and community providers. Table 3 below provides the timeline of implementaiton of each intervention of the model.

The project team implemented different interventions according to the patient centred approach including: 1) scheduled appointments for a given time in a day, differentiated from standard of care in that scheduled appointments, if in existence, were based on the day, not time of day; 2) revise patient flow within facilities to ensure integration rather than disease/condition-focused consultation rooms; 3) nurse/midwife initiated and managed ART with clients starting and continuing treatment at point of care; 4) ‘down referral’ or ‘decanting’ whereby consenting clients on ART were transferred to primary care facilities closer to their homes for continued lifelong management; 5) establisment or re-establishment of patient care team meetings whereby a multi-disciplinary team meets regularly to discuss clinical cases and program management; 6) start-up and facilitiation of health club meetings (in the community as well as facility) for people living with chronic diseases; and 7) training and deployment of peer educators and community members to conduct home visits for people living with chronic diseases, not only HIV. Components of the model were implemented at different times in different sites for a myriad of reasons. Facilities implementing specific aspects of the model by February 2016 are highlighted in dark green; at least 3 months of implementation (March-April 2016) in light green, and any other exposure during the evaluation period (May-July 2016) in yellow.

Implementation of the model necessitated a phased approach, given the number of facilities, interventions and stakeholders involved in the project. It should be noted that the CDC-funded project supports piloting of the model in 43 facilities in two regions of the country, and the programme staff are responsible for ensuring all sites are oriented and provided technical support for implementation. We expected to see an effect on retention and adherence once all elements of the model were in place for a period of six months; unfortunately, no facilities had all 7 components implemented by 1 February 2016. Fundamental aspects of the model that were implemented across most sites included nurse initiation of ART and commencement of chronic clubs. These two aspects are fundamental to the model of care and adequate elements for the intervention to be considered implemented for effect; however it should be noted that all aspects of the theory of change are deemed important. Down-referral of ART clients, CHW conducting of home visits, and patient care team meetings started later in the implementation phase across most sites. Results are likely impacted by level of implementation at each facility during the period of evaluation. We plan to conduct a final assessment during project year 5 of the CDC-funded project.

Table 3: Implementation Timeline of the integrated model of care

	Intervention / Facility	9	10	11	12	13	14	15	16
Start up activities	Provider orientation on the chronic care model	Aug-15							
	Provider training for integrated management of chronic diseases	Feb-16							
	Training for nurses and midwives on prescription of ART (task shifting)	Nov-15							
	Training for CHWs on key messages for chronic diseases	Apr-16							
	Training for providers on data management related to the model	Mar-16							
	Provision of data collection tools (registers, report cards)	Mar-16							
	Provision of materials for project activities (telephones, glucometers, BP cuffs)	May-16							
Core Model Components	Initiation of use of appointment cards	Oct-16	Oct-16	Sep-16	Sep-16	Aug-16	Sep-16	Nov-16	Dec-16*
	Date of revision for patient flow for those with chronic diseases (if applicable)	Jun-16	Oct-16	Mar-16	May-16	Nov-16	N/A^	May-16	Feb-16
	Date of ARV prescription by nurses and midwives**	Dec-15	Dec-15	Dec-15	Dec-15	Dec-15	Dec-15	Nov-16	Dec-15
	Beginning of down referral	Jul-16	Oct-16	Mar-16	May-16	Feb-16	Mar-16	Nov-16	Jan-16
	Beginning of Patient Care Team Meetings	Mar-16	Mar-16	Feb-16	May-16	Feb-16	May-16	Jun-16	Feb-16
	Beginning of Health Club Meetings**	Feb-16	Mar-16	Feb-16	Feb-16	Feb-16	Feb-16	Mar-16	Feb-16
	Beginning of home visits (paper-based forms or *CommCare)	Jun-16	May-16	May-16	May-16	May-16	Jun-16	May-16	May-16

*The facility had a scheduling agenda already in place by the implementing partner, and as a result, there was reluctance of providers to use hourly appointment cards. However, positive feedback from other facilties regarding their experience during a workshop in November led the facility to request appointment cards, which they are now using

**Fundamental components implemented by Feb considered to affect outcomes

^This facility only has one building. The flow of patients was not changed because it is already well adapted for integrated management of chronic diseases

There were challenges with implementation. Ensuring proper government support and involvement at all levels of the health care system takes a great deal of time, and this is a

complex model that involves multiple programmes, service providers and other stakeholders that are vertical by technical area.

Overall, implementation went as well as could be expected in N'Zi-Iffou besides the initial six-month delay. The model has been well-received by staff at all levels of the healthcare system, including regional, district and facility levels. The development of a national committee to oversee the development and implementation was deferred to CDC project year three due to delay in start-up and the complicated structure of the various technical departments of the healthcare system. After multiple attempts, it became evident that bringing together all relevant centrally-led national programmes and departments (HIV, TB, metabolic diseases, etc.) was not feasible given the various priorities and commitments of the representatives of each.

4. Data and methods

Jhpiego received IRB approval from JHBSPH full committee in June 2015, pending Côte d'Ivoire ethical review board's (CNER) approval, which was received in August 2015. Minor modifications were made to the protocol and tools during study implementation.

Data collected included facility visit information from individual PLHIV clinical enrolment records, individual clinical follow-up forms, and pharmacy dispensing registers for the quantitative analysis; qualitative interviews and focus group discussions (FGDs) for the qualitative analysis; and phone surveys for the CEA analysis.

The final IRB approved tools can be found as Appendix A Tool #1 quantitative clinical data abstraction; Tool #2 qualitative client interview and focus group guide; Tool #3 qualitative provider interview guide; and Tool #4 client phone survey).

All facilities involved in this study are under the administration of the Ministry of Health (MOH). Sites were purposefully sampled due to the small number of facilities offering HIV treatment, care, and support services in each region. Sites from intervention and comparison regions were matched based upon: level of care, number of clients initiated on ART between 1 April and 30 September 2014, and retention (currently on ART / ever started at the site) based upon data available when the proposal was drafted.

A. *Inclusion criteria:* an urban health centre, general hospital, regional hospital, or mother-infant clinic offering ART to adults and children in the regions of N'zi-Iffou (intervention) or Indénié-Djuablin (control).
B. *Exclusion criteria:* facilities outside Regions of N'zi-Ifou or Indené-Djuablin; facilities which do not routinely offer ART to adults and children, and those facilities that offer ART but have fewer than 40 clients currently on treatment as of end September 2014.

Quantitative

The evaluation team retrospectively reviewed clinical and pharmacy records to evaluate adherence and retention to treatment.

- *Inclusion criteria for records:* individuals who initiated ART or TB treatment on or after 1 January 2013 at the selected health facilities. Healthcare service delivery (age at which a person is admitted to an adult or paediatric ward or receive care in adult outpatient units), and the monitoring and evaluation system in Côte d'Ivoire, considers individuals 15 years of age or older to be 'adults', however age of consent is 18. Due to the fact that national age categories for reporting on ART specifically are 0-11 months, 1-4 years, 5-14 years, 15-24 years, and >24 years, we include all individuals who initiated ART at the age of 15 or above.[30] This is only the case for the quantitative record review; for interviews, age of consent was considered adult at 18 years of age.
- *Exclusion criteria for records:* individuals < 15 years of age at ART initiation; adults who transferred into any study facility already on ART; adults who initiated ART prior to 1 January 2013; adults who initiated ART more than one time during the study period. If more than one ART initiation date was listed within clinical records, we used the later start date.

We calculated the sample size based on several sources of preliminary data, including our own initial data collection and feedback from 3ie. We used data available at the time of writing the proposal, April through September 2014, to estimate number of adults expected to be initiated on ART during the six-month study intervention period. Table 4 provides sample size estimate by study arm and our estimates of the number of adults enrolled on ART in different calendar quarters. We used these estimates along with our own preliminary results to inform a revised power calculation for the main impact evaluation of the chronic care intervention, with the main outcome of 6-month retention.

Based upon local programmatic evidence in Côte d'Ivoire, we assumed an expected retention rate of 79% at six months. Standard program reporting documents individuals lost to follow up (LTFU) from treatment - thus not retained - at 12 months. The national retention rate at 12 months in 2013 was estimated to be 67%, and an analysis by Kan et al. indicated 63.7% of clients who became LTFU were lost before 6 months on ART.[31] We therefore calculated that 21% of the LTFU occurs in the first six months of treatment (63.7% of 33% LTFU/not retained). We defined retention on ART using two different windows – 90 and 180 days. We utilised two definitions of retention[32] : 1) assessing whether the client returned on time for scheduled followup visits recorded in the clinical record; and 2) assessing whether the patient returned during the windows of interest regardless of whether a scheduled visit was recorded. We used the average retention observed across study sites for each of these definitions, i.e., 48.4%, 54.1%, and 58.4%, respectively. These estimates are notably lower than our estimate of 79%. We focused on obtaining a conservative estimate of statistical power, and focused on our primary definition of retention rate in the comparison arm.

[30] *République de Côte d'Ivoire, Ministère de la Santé et de l'Hygiène Publique: Registre de TARV*.

[31] Kan, V. K., Coly, A., N'Guessan, J., Dobe, S., Agbo, S., Zimin, T. Traore, V. (2014). *Facteurs Influençant la Sortie des Patients Vivant avec le VIH du Circuit de Traitement en Côte d'Ivoire*

[32] Rollins, N. C., Becquet, R., Orne-Gliemann, J., Phiri, S., Hayashi, C., Baller, A., & Shaffer, N. (2014). Defining and analyzing retention-in-care among pregnant and breastfeeding HIV-infected women: unpacking the data to interpret and improve PMTCT outcomes. *J Acquir Immune Defic Syndr, 67 Suppl 2*, S150-156. doi:10.1097/qai.0000000000000355

Table 4. Expected number of clients to be enrolled for primary and secondary outcomes based on programme data from April-September 2014

	Total clients who initiated ART between 1 Apr & 30 Sep 2014^	Estimated adults newly initiated treatment from Apr – Sep 2014 (-10% paediatric) *	Total current clients on ART as of 30 Sep 2014 among all who ever started	Estimated adults currently on ART as of 30 Sep 2014 (-10% for paediatric)	Estimated number of adults who initiated ART between 1 Jan 2013 and 30 June 2016**
Intervention (8 sites)	280	**252**	1994	1795	**1638**
Comparison (8 sites)	250	**225**	2889	2600	**1462**
Total	530	**477**	4883	4395	**3100**

^data disaggregated by age was not available for estimation, but nationally children make up less than 10% of all clients receiving ART

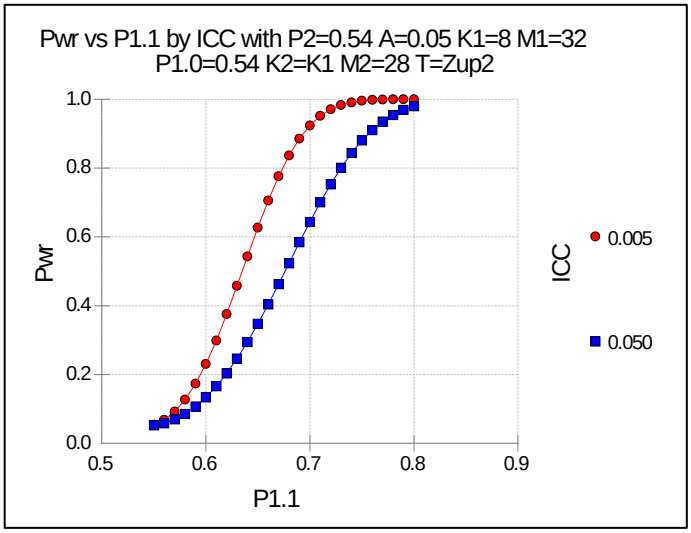
**used to calculate sample size for primary analysis*

***used to calculate sample size for secondary analysis: estimated newly enrolled adult clients per 6-month time period x 6.5 time periods (January 2013 to April 2016) = 3100*

Based on literature of group-randomized trials in similar settings, we expected our observed intraclass correlation coefficient (ICC) to be 0.005 to 0.05. With a 0.05 ICC, we calculated that the primary analysis would have 80% statistical power to detect an improvement in 6-month retention from 54.1% to 71% in the intervention group vs. no increase in the comparison group. If the ICC is only 0.005, then we expect to have 80% power to detect a smaller improvement, from 54.1% to 66%. These estimates correspond to 8 clinics in each of the study regions, with an average of 30 new clients per clinic, for a grand total of 480 participants across all sites. The estimation for this quasi-experimental study was approximated using power calculations designed for a cluster randomized control trial (RCT), and using average cluster sizes based on the estimated number of clients who initiated ART in a six-month period in all 16 sites (eight sites per arm). We estimated we would need 480 individuals, and we included 766 individuals in our analysis who had started ARV bteween July 2015 – June 2016; therefore our study was powered to detect a difference of the magnitude we had hypothesised.

Figure 3 shows the statistical power curve for the comparison using a 60-day retention definition at the six month time point. Two curves are shown, one with the intraclass correlation equal to 0.05, and the other with ICC=0.005. We assume eight clusters per arm with average cluster sizes as noted above, and a retention rate of 54.1% in the control arm.

Figure 3. Statistical power for retention at 6 months, using the 60-day definition of retention



Further information about the power calculation is in Appendix B.

We included all clients at each facility who were eligible for the study based on our criteria, therefore bias was minimized and we obtained a representative sample of clients at each facility. We were limited by the quality of the clinical and pharmacy data, as we relied on the facility records for all analyses. The data were not intended for research purposes, and therefore we chose data elements that best suited our purposes to address study goals.

Retrospective clinical and pharmacy record review of PLHIV on ART and TB patients did not entail recruitment or enrolment of individuals. We reviewed clinical records in order to abstract de-identified data for analysis at two separate time points. Initially, the objective was to collect data for a two-year period before the initial planned start of the intervention, which meant any client who began treatment on or after 1 January 2013 up until the period of collection (end-July 2015), using REDCap; this constituted the first round of data collection. Limitations due to budgetary constraints and challenges with REDCap meant that data were only completely collected from 11 sites, partial data were collected from 3 sites, and no data were collected from 2 sites. These data were used to get an early indication of patient characteristics and retention and adherence.

Due to these challenges with initial quantitative data collection using REDCap Offline, it was decided that Captricity, an Optical Character Recognition (OCR), would be used to collect outstanding data, including record of all clients who initiated ART since the previous data collection period. Captricity integrates machine learning and human validation with OCR to capture critical data from handwritten and printed text, converting information into actionable data while maintaining 99% accuracy. A password-protected account was set up to allow upload of images for cleaning. These data were collected in August 2016 and included collection of all outstanding records of individuals initiating treatment from 1 January 2013, new abstraction of clients initiating ART between August 2015 and 30 June 2016, as well as

abstraction from records previously reviewed during the initial data collection to include the follow-up period from August 2015 to July 2016.

When capturing data through Captricity, data collectors took photos of all relevant pages of the patient file or pharmacy register, respectively. Photos were securely saved and then uploaded to Captricity's server. One person uploaded all images into the Captricity software, essentially digitizing data points based on pre-defined templates. Data collectors then reviewed and cleaned individual de-identified "shreds" of data. Once digitized, if a piece of data was not verifiable due to poor image quality, illegible handwriting, or a broken validation rule, then the shred was deemed as "impossible." Study staff reviewed and manually corrected all fields marked "impossible" through Captricity's custom interface, comparing individual fields to images of the documents. Problems with the Captricity recognition system necessitated additional data capture from patient follow-up-forms using the online version of REDCap forms by data capturers. De-identified data from both sources – Captricity and REDCap - were downloaded into a .csv file, and uploaded into SAS for additional cleaning and analysis. All study data were then analyzed. In particular, all patient clinic and pharmacy visits between 1 July 2015 and 30 June 2016 were analyzed for retention and adherence.

Demographic and clinical characteristics of clients starting ART between 1 January 2013 and 30 June 2016 (entire dataset) and 1 July 2015 and 30 June 2016 (newly initiated during time period of the evaluation) were summarized using descriptive statistics. Differences between distributions were compared using chi-square tests. Fisher's exact test was used when any cells were less than five.

Age in years (as of ART start date) was categorized into five groups: 15-19, 20-29, 30-49, 50-64, and 65 and older. Sex was defined as male or female. Living with HIV was categorized as less than 1 year, 1-5 years, or more than 5 years. Education level was classified as none, primary, secondary, or post-secondary. Religion was classified as: Christian, Muslim, Animist, other, or no religion. Marital status was classified as: living together, single, married, widowed, or divorced. Work status was defined as: working, unemployed, retired, or student. Contraception use, currently pregnant, and tuberculosis were classified as yes, no, or not applicable. HIV test result was classified as: HIV-1, HIV-2, HIV-1 and HIV-2, or not indicated. 'Referred from' were classified as: voluntary counselling and testing (VCT), PMTCT, outpatient medicine, outpatient paediatrics, TB clinic, inpatient hospitalization, self-referral, or other. Prior ART was dichotomized as yes or no. Prior PMTCT was classified as yes, no, or don't know. Continuous weight and CD4 count on day 0 were also available.

We used clinical and pharmacy records to construct measures of retention and adherence, respectively. The clinical records included the scheduled date of the next visit, and the recorded visit date for each followup visit made by the patient. The pharmacy records included the date of dispensing medication and how much medication had been dispensed. Our main analytic goal using both clinical and pharmacy data was to make a comparison between the intervention region and the comparison region, with primary outcome being retention/adherence. In preliminary analyses, we examined the data by stratifying the sample of HIV clients into monthly

cohorts based on the date that ARV was started. Within each monthly cohort, using pharmacy data we calculated adherence and percent coverage on an individual basis, then aggregated individual-level adherence and percent coverage results into a group comparison of the main outcomes. Within each cohort for the clinical data, we constructed dichotomous measures of retention for two main follow-up timepoints: 90 days and 180 days. For our difference-in-difference analysis, we fit a multivariable model including a dummy variable for intervention vs. comparison region, a dummy variable for time period (before or after intervention implementation) and the interaction between these two variables. The interaction term was interpreted to serve as the test of intervention impact, because it tests for a change in the observed regional difference after the intervention was implemented.

For our analysis using propensity score matching, we used baseline data at the time of ART initiation to calculate a score for each individual. Predictor variables in the propensity model were baseline variables, including those that were imbalanced at baseline. The outcome variable in the model was the region (intervention vs. comparison). We used the psmatch2 function in STATA to generate prospensity score matched datasets for each outcome (30, 90, and 180 days), as a different set of patients was needed to evaluate the different retention timepoints during the period after the implementation had begun. Considering that the intervention began 1 February 2016, and we had follow-up data through July 2016, we used the following sets of people to generate the propensity score matched datasets: 30-day retention we included patients who began ART between 1 January 2016 and 30 June 2016; 90-day retention we included clients who began ART between 1 November 2015 and 31 March 2016; 180-day retention included patients who began ART between 1 July and 31 December 2015. Using the psmatch2 function in STATA, we generated the propensity score matched dataset for each outcome, and imported this dataset back into SAS to conduct the final analysis comparing retention outcomes between the intervention and comparison regions.

In the primary definition of retention, we evaluated whether each patient returned for a follow-up visit during a specified window around each timepoint of interest. The qualifing windows were defined as 7-44 days for the “first or second” visit; 60-134 days for the 90-day timepoint since initiation of ART, and 135-210 days for the 180-day timepoint since ART initiation. In the second definition of retention, we compared the visit date that was scheduled for each timepoint, with the date of the recorded visit made by the patient. If the patient returned within two weeks of the scheduled visit, we considered the patient to be retained at that timepoint.

Using pharmacy records, we constructed dichotomous cumulative measures of adherence to ARV for several different follow-up periods: 30 days, 60 days, 90 days, and 180 days. The pharmacy records showed the date medications were dispensed, and how many days’ worth of medication were dispensed. We assumed that patients took all medication dispensed, and we considered a person to be adherent if she or he returned to the pharmacy to obtain more medication before the previous prescription ran out, or up to three days afterwards. If a patient returned more than three days after the medication was expected to run out, we considered her/him non-adherent. These cumulative measures look across the entire follow-up period and are constructed as time-to-event or survival-type variables, where the event of interest is

becoming non-adherent as defined by being more than three days late for a return visit to the pharmacy.

In addition to these adherence variables, we calculated percent coverage by medication over the same time periods. These measures (30 days, 60 days, 90 days, and 180 days) were calculated as the total number of days' worth of ART received by the patient for use in the relevant follow-up period, divided by the total number of days in the follow-up period. The measures are expressed as a ratio from 0 to 1. In the measure of percent coverage, we gave clients credit for all medication that they received during the relevant time period.

Cumulative percent coverage was summarized by means and SD, and cumulative adherence to medication was examined at 30, 60, and 90 days by percentages. *P*-values <0.05 were considered statistically significant. SAS 9.3 was used for analysis.

Qualitative

The sample is based upon qualitative interviews at endline with two intervention and two comparison facilities (one hospital and health centre in each study group). Inclusion criteria for clients was being age 18 or older and have started ART within past nine months. Individuals living outside of the local vicinity or hospitalized at time of recruitment were excluded. Inclusion criteria for providers was being a nurse, pharmacist or community counsellor at the facility providing care to PLHIV.

The purpose of qualitative research is to produce information-rich data from a sample of individuals selected for their ability to speak on an issue. The emphasis is on depth of understanding of an issue and generating insights from selected participants. A priori sampling is used in much health systems-related qualitative research, in which the research questions and purpose are defined as well as the characteristics of the desired participants. We sample individuals who may have different perspectives based on their relevant characteristics to fully understand the issues under study. The number of participants included in each category was based on estimates about how many individuals are needed to reach saturation of themes. We used quota sampling[33] to capture a range of beliefs and experiences thought to be relevant for ART appointment adherence. Budget was also a consideration when determining the number of facilities to include in the qualitative study.

Table 5. Sample size of qualitative research participants at endline, by study group

	Intervention		Control		Total
	Hospital	Health Centre	Hospital	Health Centre	
In-depth Interview					
Patients on ART					
Missed appointment by 3+ days [1 man, 1 woman]	2	2	2	2	8

[33] Mack, M., Woodsong, C., MacQueen, K.M., Guest, G. and Namey, E. 2005, Qualitative Research Methods: A Data Collector's Field Guide, Family Health International, Research Triangle Park, NC

Pregnant before or during ART	1	1	1	1	4
Providers *(a)*					
Community counsellor	1	1	1	1	4
Nurse	1	1	1	1	4
Pharmacist or Pharmacy Assistant	1	0-1	1	0-1	4
Focus Group Discussions *(b)*					
With an existing PLHIV group that already comes to clinic OR who meet in the community (maximum of 10 per group) *(c)*	1-4 (10 to 40)	1-4 (10 to 40)	1-4 (10 to 40)	1-4 (10 to 40)	4-8 (40-80)
Total number of transcripts (discussions)	**7-10**	**7-10**	**7-10**	**7-10**	**28 - 40**
Total number of human participants to consent (range)	Up to 46	Up to 46	Up to 46	Up to 46	184 max

(a) The provider interview depends on provider availability during time of interviewer's visit to the facility. Interviewer will attempt to call first and arrange a convenient time and make 2+ attempts.

(b) If a group of PLHIV does not exist or meet regularly, then the focus group may not occur and may be substituted with a client interview. These are patients engaged in care.

(c) Focus groups will be homogenous. Adolescents/young adults should be separated from older clients. Women and men will be in focus groups. There can be up to 4 groups per site or there can be fewer: the number of focus groups will depend what PLHIV already meet as a group and feel comfortable being in a focus group together.

The interview and focus group guides for use with the clients and the providers were developed by the team of investigators from Côte d'Ivoire, South Africa, and USA in line with the Theory of Change and review of the literature.[34,35,36] The field guides were developed for qualitative in-depth interviews with healthcare workers and clients living with HIV and focus group discussions with people living with chronic diseases, including HIV. The guides were designed to elicit information on several topics relevant to adherence and retention. Specifically, barriers to uptake of the intervention were solicited and consisted of open-ended questions followed by probing questions. The field guides underwent minor modifications after continued discussions with the investigators in Cote d'Ivoire and a better understanding of the intervention being implemented. The guides were translated into French and reviewed for accuracy by project staff fluent in both languages.

The field guides for patients on ART collected data on socio-demographic characteristics and details related to HIV care and treatment. Interviewers asked clients about the difficulty of transportation to the clinic, typical situations that affected their ability to seek care, and obligations competing with their appointments including childcare, work, community or familial pressures. They also discussed reasons behind missed appointments and mechanisms to remember appointments. Clients recounted their experience disclosing their HIV status and

[34] Institut National de la Statistique (INS) and ICF International, 2012. *Enquête Démographique et de Santé et à Indicateurs Multiples de Côte d'Ivoire 2011-2012*. Calverton, Maryland, USA

[35] World Health Organization, 2013. *Global Update on HIV Treatment 2013: Results, Impact and Opportunities (June)*. Retrieved from http://apps.who.int/iris/bitstream/10665/85326/1/9789241505734_eng.pdf

[36] *Resultats annuels PEPFAR CI FY 2013* (Presentation)

explored community attitudes and stigma related to HIV and other chronic diseases as well as the integration of clinics in their community. Questions asked about the role of traditional healers and also participation in newly formed health clubs for chronic conditions. Interviewers specifically asked clients about aspects of care addressed during their appointments including family planning, tuberculosis, hypertension, and referrals and also for recommendations.

The field guide for provider interviews had open-ended questions about the providers' demographic characteristics and nature of their duties related to HIV clients. Interviewers asked providers about successes, shortcomings and recent changes of their programmes related to input factors, structural aspects, policies, guidelines and distribution of tasks. Several dimensions of client attendance at their appointments were explored including perceived barriers. A few questions focused on successes and challenges of documentation and reporting for HIV and other chronic conditions. Interviewers also asked providers about interventions to improve appointment attendance and community health literacy about chronic conditions, services offered at the clinic, and the referral system. Finally, participants were asked for recommendations to improve client outcomes, the work environment, and integration of care.

The week prior to data collection, two qualitative interviewers and two transcribers were oriented to the study goals, planned activities, ethics, and qualitative interviewing best practices (in-depth interviews, focus groups and transcription) by the lead qualitative investigator, the SCI-VIH Project Director, and the M&E Manager.

Recruitment and data collection occurred during two weeks in May 2016. There were three respondent types: a) ART patients who have missed an appointment by three or more days; b) PLHIV group who already meets at the clinic or in the community; and c) providers (doctor, nurse or pharmacist) (Table 5). To recruit ART patients who missed appointment, the interviewers asked providers to identify patients in the medical records. The provider telephoned the patient to remind them about the appointment and ask/invite the patient whether an interviewer can meet the client for an interview or for a focus group; this conversation served as the initial recruitment. We had planned for providers to ask PLHIV groups that already meet at the clinic or in the community whether a study-related focus group discussion could be held. Upon arrival at the sites, these groups were not found to exist. Clients fitting the age and gender profile were sought by the providers calling them. To recruit providers, the interviewers asked the provider while at clinic for a short interview when the provider was not working.

All qualitative discussions took place at the health facility due to accessibility and the ability to have a space allowing for audio and visual privacy. Interviews were conducted in French. The interviews and focus groups were carried out by sociologists experienced in health and affiliated with the co-investigator at the MOH. The interviewers had originated from the regions where the data were being collected but did not know people in the specific catchment areas of the clinics. Sometimes the questions were asked in the local language when the participant did not understand the question in French. The interviewers and transcribers speak French and the local language.

Each discussion was audio recorded with permission of the participants and lasted approximately 60–90 minutes. The transcriber typed up the discussion within one week

following the interviews. When passages were expressed orally in local languages, the transcription included passages in both languages. Transcriptions were reviewed and approved by the interviewer within one week and by the lead qualitative researcher within one month of the in-depth interviews and FGDs.

Atlas-ti 7.5 software (Scientific Software Development GmbH, Berlin, Germany) was used to code passages or utterances (also called indexing and sorting)[37]. The coding matrix was drafted based on the field guide's questions and probes. Additional emergent codes were added as needed. To help standardize the approach of coding, initially, two reviewers coded the same few transcripts and met to discuss how the codes were being applied, and which codes were being used and proposed. Overall, three coders with experience in qualitative research coded all transcripts (one coder per transcript) and met regularly to discuss what codes were used.

Once all transcripts are coded, codes were placed into lists grouped by relevance to a research question. In Atlas-ti query reports, selected code groups were used to retrieve relevant passages from the transcripts. Following the Framework Analysis approach (Ritchie et al, 2013), a data summary matrix was created in which each row refers to a single interview or focus group, each column with a sub-theme, and each cell with a quotation. The matrix allowed for key data from all participants to be visible in a large display. The data summary matrix can be found in Appendix E.

In the abstraction and interpretation phase of analysis, the steps focused on description, categorization, and linkage identification and explanation. In description, the focus was on detection of key elements and dimensions of phenomena and these were then refined in categories and classifications. Linkages between codes were searched for between themes and sub-themes, and for this report mainly, this focused on the intervention and control group differences or similarities.

Economic costs to PLHIV

To complement efforts to measure the impact of the 3ie chronic care model on adherence and retention, we additionally sought to assess the economic consequences of illness. Unexpected increases in health expenditures, reductions in individual income or productivity, may translate into 'health shocks' which are a risk factor for impoverishment, particularly in low and middle income countries where much of the costs of health services are borne by patients.

Côte d'Ivoire, like many PEPFAR supported countries, has mandated that antiretrovirals, clinical tests and exams, consultation and other fees related to HIV identification, care and treatment, be provided free of charge to patients. In practice, however, patients incur substantial out of pocket costs directly and indirectly related to HIV care and treatment. Programmatic activities, including efforts to frame HIV in the context of other chronic diseases to reduce stigma, and/or shift medicine distribution to the community/household level may significantly lessen the economic burden of HIV to households.

[37] Ritchie J, Lewis J, Nicholls CM, et al, 2013. Qualitative Research Practice: A Guide for Social Science Students and Researchers. 2nd ed. London, United Kingdom: Sage Publications, Ltd.

From July to early September 2016, a team of four social scientists with prior experience working with PLHIV implemented a phone survey to a target constituency of 20 PLHIV recruited in each of the 16 study area facilities (eight intervention, eight comparison) for a total sample size of 320. Data collectors received a week of training in research ethics, survey design, and implementation from Jhpiego and JHSPH faculty. PLHIV were recruited by providers whom informed them of the study objectives and invited them participate in the survey in exchange for a small airtime phone voucher. Study participants were given the opportunity to request a specific time to be called for the interview and where possible, data collectors sought to adhere to the recommended call time. Interviews spanned for an average of 45 minute in duration and an estimated 25% were conducted between 7am and 10am in the morning whilst 12% were conducted between 5pm and 9pm in the evening.

The survey instrument used include modules on socio-demographic and background characteristics of respondents, HIV characteristics, service information (including direct and indirect costs), equity and financial risk, as well as general knowledge. Data entry occurred in Abidjan at Jhpiego offices using RedCAP and ultimately a de-identified data set was analysed using Stata 13.0.

5. Results

Quantitative

Retention

In our analysis of data from the clinical record (time period January 2013 to June 2016), we collected a total of 16,135 clinical visits made by 2,519 individuals. For 225 individuals, we found only one clinical follow-up visit during ART care; the remaining individuals had multiple visits observed, up to a maximum of 22 visits by one client (See Table 6).

Table 6. Observed number of clinical visits made per individual client

Visit number	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1	225	8.93	225	8.93
2	188	7.46	413	16.40
3	458	18.18	871	34.58
4	157	6.23	1028	40.81
5	148	5.88	1176	46.69
6	143	5.68	1319	52.36
7	175	6.95	1494	59.31
8	161	6.39	1655	65.70
9	200	7.94	1855	73.64
10	177	7.03	2032	80.67
11	173	6.87	2205	87.53
12	100	3.97	2305	91.50
13	75	2.98	2380	94.48
14	49	1.95	2429	96.43
15	36	1.43	2465	97.86
16	20	0.79	2485	98.65
17	15	0.60	2500	99.25
18	6	0.24	2506	99.48

Visit number	Frequency	Percent	Cumulative Frequency	Cumulative Percent
19	5	0.20	2511	99.68
20	5	0.20	2516	99.88
21	2	0.08	2518	99.96
22	1	0.04	2519	100.00

There were 2,519 individuals who initiatied ART between January 2013 and June 2016 who were included in our analysis. Demographic and clinical characteristics at enrolment into care are displayed overall and by intervention vs. control group (Table 7). The populations evaluated across the two regions were significantly different for most demographic characteristics. Of those clients who enrolled into care between 1 January 2013 and 30 June 2016 (n=2,519), 1,215 (48.2%) received the intervention and 1,304 (51.8%) received the standard of care in the control region. Most patients were female (73.6%), nearly half did not have any education, and a majority reported being employed (88.2%). Education level, contraception history, HIV/AIDS test result, prior PMTCT, and currently pregnant were similar between intervention and control regions; however, sex, age, years living with HIV, religion, marital status, work status, TB history, place of referral, and prior ART differed significantly ($p<0.05$).

Table 7. Characteristics of clients who initiated ART between 1 January 2013 and 30 June 2016 (see Appendix C for complete table)

Characteristic	Control (n=1,304, 51.8%), n (%)	Intervention (n=1,215, 48.2%), n (%)	Overall (n=2,519), n (%)	*p*-value
Sex				
Male	265 (22.2)	364 (30.5)	629 (26.4)	<.0001**
Female	927 (77.8)	829 (69.5)	1,756 (73.6)	
No response	*112 (8.6)*	*22 (1.8)*	*134 (5.3)*	
Years living with HIV				
Less than 1 year	131 (16.8)	119 (10.8)	250 (13.3)	.0007**
1-5 years	609 (78.0)	930 (84.2)	1,539 (81.6)	
More than 5 years	41 (5.3)	55 (5.0)	96 (5.1)	
Missing	*523 (40.1)*	*111 (9.1)*	*634 (25.2)*	
Age (years)				
15-19	17 (1.5)	18 (1.5)	35 (1.5)	.0002**
20-29	186 (16.0)	166 (14.2)	352 (15.1)	
30-49	719 (61.9)	722 (61.7)	1,441 (61.8)	
50-64	175 (15.1)	234 (20.0)	409 (17.5)	
65 and older	65 (5.6)	31 (2.7)	96 (4.1)	
Missing	*142 (10.9)*	*44 (3.6)*	*186 (7.4)*	
Level of education				
None	464 (49.5)	611 (52.8)	1,075 (51.3)	.2235
Primary	270 (28.8)	320 (27.7)	590 (28.2)	
Secondary	172 (18.4)	180 (15.6)	352 (16.8)	
Post-secondary	31 (3.3)	46 (4.0)	77 (3.7)	
Missing/No response	*367 (28.1)*	*58 (4.8)*	*425 (16.9)*	

Religion				
Christian	594 (65.4)	740 (65.7)	1,334 (65.5)	<.0001**
Muslim	244 (26.8)	182 (16.2)	426 (20.9)	
Animist	26 (2.9)	79 (7.0)	105 (5.2)	
Other	2 (0.2)	10 (0.9)	12 (0.6)	
No religion	43 (4.7)	116 (10.3)	159 (7.8)	
No response	*395 (30.3)*	*88 (7.2)*	*483 (19.2)*	
Marital status				
Living together	245 (52.8)	414 (50.5)	659 (51.3)	.0178*
Single	124 (26.7)	258 (31.5)	382 (29.8)	
Married	36 (7.8)	41 (5.0)	77 (6.0)	
Widowed	41 (8.8)	91 (11.1)	132 (10.3)	
Divorced	18 (3.9)	16 (2.0)	34 (2.7)	
Missing/No response	*840 (64.4)*	*395 (32.5)*	*1,235 (49.0)*	
Work status				
Working	522 (80.7)	858 (93.6)	1,380 (88.2)	<.0001**
Unemployed	119 (18.4)	37 (4.0)	156 (10.0)	
Retired	5 (0.8)	15 (1.6)	20 (1.3)	
Student	1 (0.2)	7 (0.8)	8 (0.5)	
Missing/No response	*657 (50.4)*	*298 (24.5)*	*955 (37.9)*	

Note: Chi-square values are based on available data and exclude non responses. Fisher's exact test was used as possible when one or more cells was less than 5.
*=Statistical significance at p<0.05.
**=Statistical significance at p<0.01.

Given the evidence that the largest drop in retention occurs in the first 6-12 months of treatment, we analyzed the cohort of PLHIV newly initiating ART between 1 July 2015 and 30 June 2016 separately in Table 8. The demographic characteristics were more similar than the larger cohort from January 2013, religion and work status being the only significant differences whereby no response rate from the control region was 2-4 times higher.

Table 8. Characteristics of clients who initiated ART between 1 July 2015 and 30 June 2016 (see Appendix C for complete table)

Characteristic	**Control (n=412, 53.7%),** n (%)	**Intervention (n=355, 46.3%),** n (%)	**Overall (n=767),** n (%)	***p*-value**
Sex				
Male	88 (23.7)	87 (25.7)	175 (24.7)	.5483
Female	283 (76.3)	252 (74.3)	535 (75.4)	
No response	*41 (10.0)*	*16 (4.5)*	*57 (7.4)*	
Years living with HIV				
Less than 1 year	98 (37.7)	105 (36.6)	203 (37.1)	.8291
1-5 years	158 (60.8)	179 (62.4)	337 (61.2)	
More than 5 years	4 (1.5)	3 (1.1)	7 (1.3)	
Missing	*152 (36.9)*	*68 (19.2)*	*220 (28.7)*	
Age (years)				
15-19	8 (2.3)	4 (1.3)	12 (1.8)	.3751
20-29	59 (16.7)	51 (16.0)	110 (16.4)	

30-49	203 (57.5)	189 (59.3)	392 (58.3)	
50-64	67 (19.0)	68 (21.3)	135 (20.1)	
65 and older	16 (4.5)	7 (2.2)	23 (3.4)	
Missing	*59 (14.3)*	*36 (10.1)*	*95 (12.4)*	
Level of education				
None	159 (50.8)	160 (47.9)	319 (49.3)	.2668
Primary	86 (27.5)	105 (31.4)	191 (29.5)	
Secondary	58 (18.5)	51 (15.3)	109 (16.9)	
Post-secondary	10 (3.2)	18 (5.4)	28 (4.3)	
Missing/No response	*99 (24.0)*	*21 (5.9)*	*120 (15.7)*	
Religion				
Christian	193 (65.7)	233 (70.4)	426 (68.2)	<.0001**
Muslim	82 (27.9)	48 (14.5)	130 (20.8)	
Animist	7 (2.4)	16 (4.8)	33 (3.7)	
Other	0 (0)	2 (0.6)	2 (0.3)	
No religion	12 (4.1)	32 (9.7)	44 (7.0)	
No response	*118 (28.6)*	*24 (6.8)*	*142 (18.5)*	
Marital status				
Living together	25 (62.5)	26 (42.7)	51 (50.1)	.1908
Single	7 (17.5)	21 (34.4)	28 (27.7)	
Married	6 (15.0)	7 (11.5)	13 (12.9)	
Widowed	1 (2.5)	5 (8.2)	6 (5.9)	
Divorced	1 (2.5)	2 (3.3)	3 (3.0)	
Missing/No response	*372 (90.3)*	*294 (82.3)*	*666 (86.8)*	
Work status				
Working	177 (88.1)	265 (95.0)	442 (92.1)	.0008**
Unemployed	20 (10.0)	6 (2.2)	26 (5.4)	
Retired	4 (2.0)	6 (2.2)	10 (2.1)	
Student	0 (0)	2 (0.7)	2 (0.4)	
Missing/No response	*211 (51.2)*	*76 (21.4)*	*287 (37.4)*	

Note: Chi-square values are based on available data and exclude non responses. Fisher's exact test was used as possible when one or more cells was less than 5.
*=Statistical significance at $p<0.05$.
**=Statistical significance at $p<0.01$.

Table 9 displays the number of participants enrolled by facility in the intervention and control groups for the entire study population. There were a total of 2,519 patients enrolled, 1,304 in the comparison region with a range of 41 to 386 enrolments per facility, and 1,215 in the intervention region, ranging from 36 to 335.

Table 9. Number of participants enrolled by matched facility for entire study population (n=2,519)

Control Facility	Total number enrolled N (%)	Intervention Facility	Total number enrolled N (%)
1	107 (8.2)	9	182 (15.0)
2	64 (4.9)	10	36 (3.0)
3	386 (29.6)	11	335 (27.6)
4	184 (14.1)	12	58 (4.8)
5	226 (17.3)	13	116 (9.6)
6	205 (15.7)	14	156 (12.8)
7	41 (3.1)	15	52 (4.3)
8	91 (7.0)	16	280 (23.1)
Total	**1,304 (51.8)**	**Total**	**1,215 (48.2)**

Control group= Indénié-Djuablin region; Intervention group=N'Zi-Ifou region

Similarly, Table 10 displays the number of participants enrolled onto ART by matched facility for the period of intervention from July 2015 to June 2016.

Table 10. Number of participants enrolled by matched facility for clients enrolled on ART between 1 July 2015 and 30 June 2016 (n=767)

Control Facility	Total number enrolled N (%)	Intervention Facility	Total number enrolled N (%)
1	36 (8.7)	9	83 (23.4)
2	15 (3.6)	10	19 (5.4)
3	117 (28.4)	11	71 (20.0)
4	72 (17.5)	12	15 (4.2)
5	60 (14.6)	13	67 (18.9)
6	89 (21.6)	14	33 (9.3)
7	14 (3.4)	15	8 (2.3)
8	9 (2.2)	16	59 (16.6)
Total	**412 (53.7)**	**Total**	**355 (46.3)**

Control group= Indénié-Djuablin region; Intervention group=N'Zi-Ifou region

In our presentation of clinical retention comparing the intervention region and the comparison region, we have calculated retention for specific cohorts of clients who started ART during specific calendar quarters or months. We present retention for quarterly cohorts starting in Quarter 1 of 2013 (January – March), and we present retention for monthly cohorts for the final year of data starting in July 2015. Clinical follow-up data was available through the end of July 2016, allowing the calculation of 30-day retention for all clients starting ART by June 2016 or earlier. Longer-term retention timepoints are calculable for earlier cohorts, and the longest-term outcome measure we calculated (three years) was available for clients beginning ART by June 2013.

We calculated retention in two different ways. First, the primary definition of retention was based on whether the client returned for a clinic visit during a specified range of days following the ART start date. Our first follow-up period encompassed day 7 – 44, because some clinicians in

Côte d'Ivoire may ask the client to return after two weeks, or after one month. Therefore we defined the time period as one week prior to the "two week" visit, or up to two weeks after the "one month" visit. Our second follow-up period, for 90 day retention, encompassed day 60 – 134. Our third follow-up period, for 180 day retention, encompassed day 135 – 210. Longer-term follow-up period were centered around 12, 18, 24, 30, and 36 months. Each of these longer-term follow-up periods was defined with a window of 3 months before or after the timepoint.

The secondary definition of retention was based on the scheduled appointment date recorded in the clinical follow-up patient file. By comparing the scheduled appointment date to the actual date when the client next returned, we classified each client as being retained (or not) at specified follow-up time periods. For this analysis, if a scheduled appointment date was missing (i.e. if no visit was recorded as being scheduled during a specified time period), we were unable to include the client in the retention analysis for that time period. Accordingly, the denominator changes for different time periods in this analysis, depending on how many clients had a scheduled appointment recorded in each specified time period.

In Table 11 we show the clinical retention observed in quarterly cohorts beginning in Q1 of 2013, and in Table 12 we show the retention observed in monthly cohorts beginning in July 2015. These measures of retention are based on clinic visits in specified intervals since the ART start date. Both give indication that clinic retention has increased over time since 2013.

Table 11. Retention in quarterly cohorts, based on clinical records: client returning to the clinic within a specified time period after ART start date.

Quarterly Cohort	Region	30 days N (%)	90 days N (%)	180 days N (%)	12 months N (%)
Jan-Mar 2013	Intervention	30/76 (39.5)	4/76 (5.3)	11/76 (14.5)	6/76 (7.9)
	Control	12/96 (12.5)	8/96 (8.3)	2/96 (2.1)	2/96 (2.1)
Apr-Jun 2013	Intervention	25/67 (37.3)	3/67 (4.5)	4/67 (6.0)	15/67 (22.4)
	Control	15/69 (21.7)	2/69 (2.9)	1/69 (1.4)	3/69 (4.3)
Jul-Sep 2013	Intervention	46/107 (43)	11/107 (10.3)	7/107 (6.5)	7/107 (6.5)
	Control	9/92 (9.8)	10/92 (10.9)	2/92 (2.2)	2/92 (2.2)
Oct-Dec 2013	Intervention	21/80 (26.3)	9/80 (11.3)	8/80 (10.0)	24/80 (30.0)
	Control	8/85 (9.4)	8/85 (9.4)	5/85 (5.9)	11/85 (12.9)
Jan-Mar 2014	Intervention	38/87 (43.7)	9/87 (10.3)	10/87 (11.5)	47/87 (54)
	Control	37/108 (34.3)	9/108 (8.3)	3/108 (2.8)	52/108 (48.1)
Apr-Jun 2014	Intervention	30/87 (34.5)	14/87 (16.1)	10/87 (11.5)	54/87 (62.1)
	Control	44/115 (38.3)	7/115 (6.1)	2/115 (1.7)	60/115 (52.2)
Jul-Sep 2014	Intervention	41/86 (47.7)	15/86 (17.4)	39/86 (45.3)	58/86 (67.4)
	Control	27/67 (40.3)	0/67 (0)	19/67 (28.4)	39/67 (58.2)
Oct-Dec 2014	Intervention	54/101 (53.5)	50/101 (49.5)	50/101 (49.5)	64/101 (63.4)
	Control	36/87 (41.4)	36/87 (41.4)	44/87 (50.6)	57/87 (65.5)
Jan-Mar 2015	Intervention	76/95 (80.0)	63/95 (66.3)	61/95 (64.2)	62/95 (65.3)
	Control	57/93 (61.3)	45/93 (48.4)	49/93 (52.7)	64/93 (68.8)
Apr-Jun 2015	Intervention	65/74 (87.8)	42/74 (56.8)	43/74 (58.1)	47/74 (63.5)

	Control	56/81 (69.1)	46/81 (56.8)	47/81 (58.0)	51/81 (63.0)
Jul-Sep 2015	Intervention	44/60 (73.3)	41/60 (68.3)	34/60 (56.7)	
	Control	41/75 (54.7)	51/75 (68.0)	55/75 (73.3)	
Oct-Dec 2015	Intervention	42/64 (65.6)	48/64 (75.0)	51/64 (79.7)	
	Control	75/114 (65.8)	87/114 (76.3)	79/114 (69.3)	
Jan-Mar 2016	Intervention	96/134 (71.6)	105/134 (78.4)		
	Control	75/107 (70.1)	78/107 (72.9)		
Apr-Jun 2016	Intervention	64/97 (66.0)			
	Control	78/115 (67.8)			

Table 11 continued.

Quarterly Cohort	Region	18 months N (%)	24 months N (%)	30 months N (%)	36 months N (%)
Jan-Mar 2013	Intervention	4/76 (5.3)	35/76 (46.1)	34/76 (44.7)	30/76 (39.5)
	Control	2/96 (2.1)	40/96 (41.7)	41/96 (42.7)	40/96 (41.7)
Apr-Jun 2013	Intervention	12/67 (17.9)	42/67 (62.7)	42/67 (62.7)	40/67 (59.7)
	Control	12/69 (17.4)	35/69 (50.7)	39/69 (56.5)	39/69 (56.5)
Jul-Sep 2013	Intervention	47/107 (43.9)	47/107 (43.9)	47/107 (43.9)	
	Control	45/92 (48.9)	45/92 (48.9)	40/92 (43.5)	
Oct-Dec 2013	Intervention	52/80 (65.0)	49/80 (61.3)	46/80 (57.5)	
	Control	36/85 (42.4)	38/85 (44.7)	34/85 (40.0)	
Jan-Mar 2014	Intervention	41/87 (47.1)	39/87 (44.8)		
	Control	48/108 (44.4)	45/108 (41.7)		
Apr-Jun 2014	Intervention	47/87 (54.0)	40/87 (46.0)		
	Control	61/115 (53)	52/115 (45.2)		
Jul-Sep 2014	Intervention	49/86 (57.0)			
	Control	38/67 (56.7)			
Oct-Dec 2014	Intervention	51/101 (50.5)			
	Control	49/87 (56.3)			

Table 12. Retention in monthly cohorts, based on clinical records: client returning to the clinic within a specified time period after ART start date.

Monthly Cohort	Region	30 days N (%)	90 days N (%)	180 days N (%)
July 2015	Intervention	25/31 (80.6)	21/31 (67.7)	16/31 (51.6)
	Control	13/22 (59.1)	17/22 (77.3)	18/22 (81.8)
Aug 2015	Intervention	13/21 (61.9)	13/21 (61.9)	12/21 (57.1)
	Control	14/26 (53.8)	17/26 (65.4)	16/26 (61.5)
Sept 2015	Intervention	6/8 (75.0)	7/8 (87.5)	6/8 (75.0)
	Control	14/ 27 (51.9)	17/27 (63.0)	21/27 (77.8)
Oct 2015	Intervention	8/11 (72.7)	8/11 (72.7)	8/11 (72.7)
	Control	16/ 24 (66.7)	15/24 (62.5)	11/24 (45.8)
Nov 2015	Intervention	13/20 (65.0)	15/20 (75.0)	16/20 (80.0)
	Control	19/32 (59.4)	24/32 (75.0)	24/32 (75.0)
Dec 2015	Intervention	21/33 (63.6)	25/33 (75.8)	27/33 (81.8)
	Control	40/58 (69.0)	48/58 (82.8)	44/58 (75.9)
Jan 2016	Intervention	34/45 (75.6)	37/45 (82.2)	

	Control	38/49 (77.6)	36/49 (73.5)
Feb 2016	Intervention	29/45 (64.4)	35/45 (77.8)
	Control	12/19 (63.2)	14/19 (73.7)
Mar 2016	Intervention	33/44 (75.0)	33/44 (75.0)
	Control	25/39 (64.1)	28/39 (71.8)
Apr 2016	Intervention	16/27 (59.3)	
	Control	21/36 (58.3)	
May 2016	Intervention	21/30 (70.0)	
	Control	31/45 (68.9)	
Jun 2016	Intervention	27/40 (67.5)	
	Control	26/34 (76.5)	

Based on our primary definition of retention as summarized in the tables above, we further present corresponding figures showing 90-day and 180-day retention for quarterly cohorts in Figures 4 and 5, and 90-day retention in monthly cohorts in Figure 6.

Figure 4. 90-day retention in quarterly cohorts, based on days since ART start date

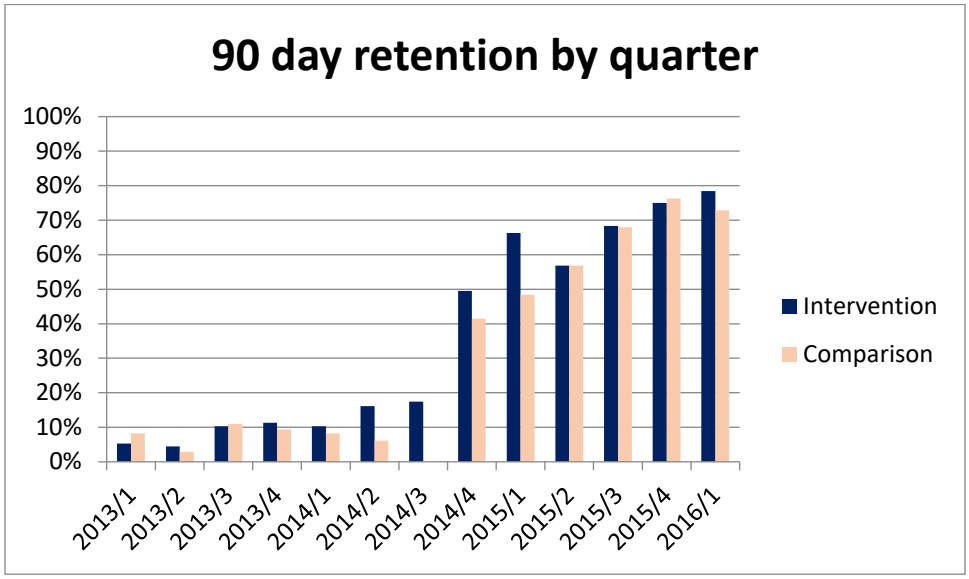


Figure 5. 180-day retention in quarterly cohorts, based on days since ART start date

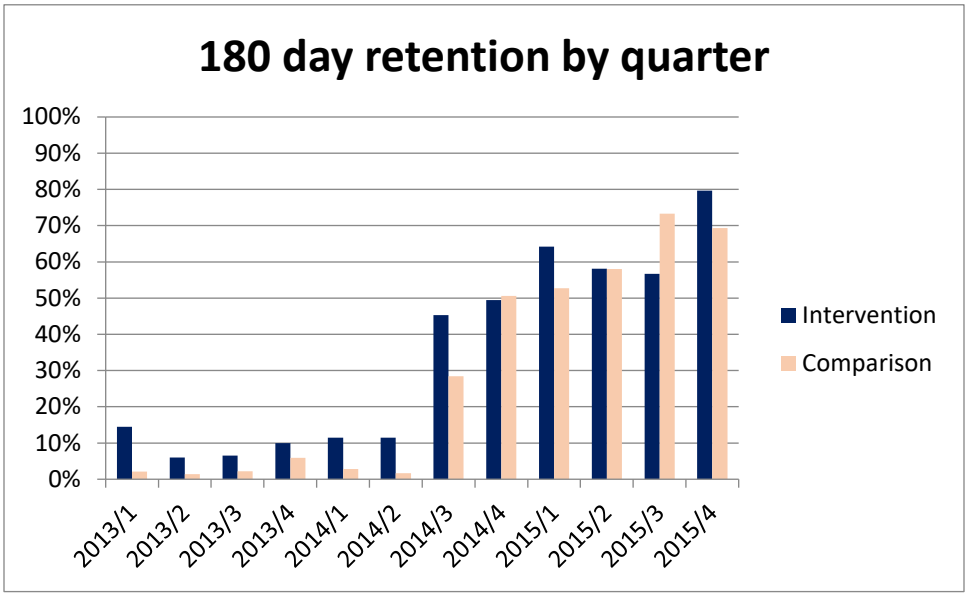
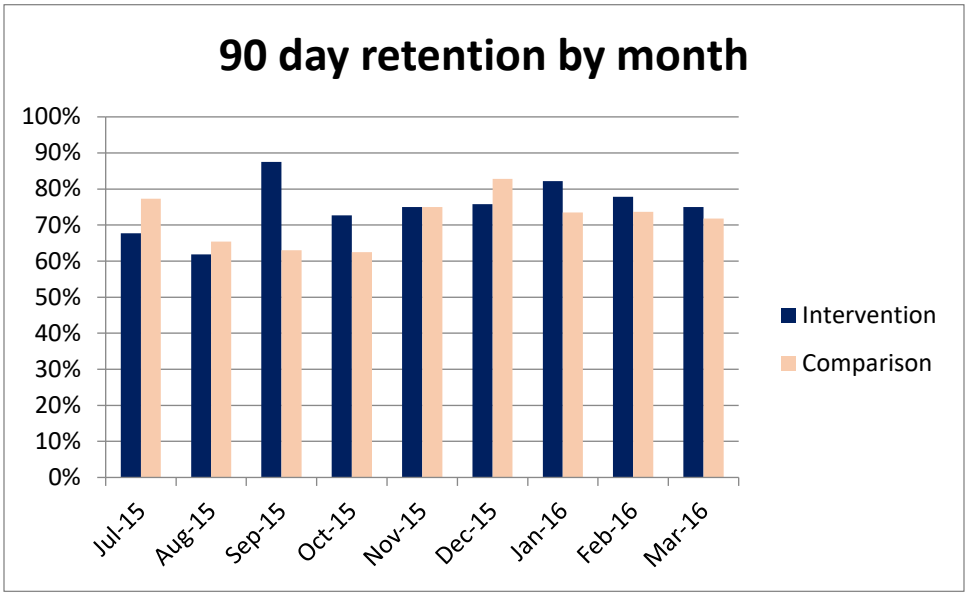


Figure 6. 90-day retention in monthly cohorts, based on days since ART start date



Results based on secondary definition of clinical retention: We conducted parallel analyses using our secondary definition of clinical retention, based on the client returning for a scheduled visit in the relevant window. In Table 13 (quarterly cohorts) and Table 14 (monthly cohorts) we show the clinical retention based on visits occurring within two weeks of the scheduled appointment date for each follow-up timepoint. In Figures 7, 8, and 9, we display 90-day and 180-day retention by quarterly cohorts, and 90-day retention in monthly cohorts, respectively.

Table 13. Retention in quarterly cohorts, based on clinical records: client returning within two weeks of scheduled appointment date

Quarterly Cohort	Region	30 days N (%)	90 days N (%)	180 days N (%)	12 months N (%)
Jan-Mar 2013 (1)	Intervention	21/24 (87.5)	0/0 (0)	1/1 (100)	0/0 (0)
	Control	6/9 (66.7)	1/1 (100)	2/2 (100)	0/1 (0)
Apr-Jun 2013 (2)	Intervention	16/20 (80.0)	0/1 (0)	1/1 (100)	2/4 (50.0)
	Control	2/5 (40.0)	0/0 (0)	0/0 (0)	0/1 (0)
Jul-Sep 2013 (3)	Intervention	39/54 (72.2)	0/0 (0)	2/3 (66.7)	0/1 (0)
	Control	6/15 (40.0)	1/1 (100)	1/1 (100)	1/1 (100)
Oct-Dec 2013 (4)	Intervention	20/25 (80.0)	0/2 (0)	0/2 (0)	4/11 (36.4)
	Control	3/11 (27.3)	1/1 (100)	1/1 (100)	1/1 (100)
Jan-Mar 2014 (1)	Intervention	26/30 (86.7)	2/4 (50.0)	0/4 (0)	28/35 (80.0)
	Control	24/35 (68.6)	2/4 (50.0)	3/3 (100)	33/39 (84.6)
Apr-Jun 2014 (2)	Intervention	22/31 (71.0)	1/8 (12.5)	0/4 (0)	40/44 (90.9)
	Control	34/47 (72.3)	2/4 (50.0)	0/0 (0)	47/56 (83.9)
Jul-Sep 2014 (3)	Intervention	23/32 (71.9)	3/14 (21.4)	8/12 (66.7)	47/53 (88.7)
	Control	21/28 (75.0)	0/0 (0)	5/7 (71.4)	34/39 (87.2)
Oct-Dec 2014 (4)	Intervention	34/53 (64.2)	18/31 (58.1)	33/47 (70.2)	53/61 (86.9)
	Control	25/32 (78.1)	12/17 (70.6)	32/42 (76.2)	51/57 (89.5)
Jan-Mar 2015 (1)	Intervention	55/74 (74.3)	41/52 (78.8)	40/51 (78.4)	50/60 (83.3)
	Control	38/61 (62.3)	28/42 (66.7)	38/49 (77.6)	54/63 (85.7)
Apr-Jun 2015 (2)	Intervention	50/65 (76.9)	31/41 (75.6)	32/37 (86.5)	40/45 (88.9)
	Control	47/61 (77.0)	36/45 (80.0)	41/47 (87.2)	43/48 (89.6)
Jul-Sep 2015 (3)	Intervention	40/53 (75.5)	35/38 (92.1)	28/36 (77.8)	
	Control	34/56 (60.7)	43/55 (78.2)	42/52 (80.8)	
Oct-Dec 2015 (4)	Intervention	36/48 (75.0)	33/43 (76.7)	34/40 (85.0)	
	Control	58/86 (67.4)	66/82 (80.5)	67/78 (85.9)	
Jan-Mar 2016 (1)	Intervention	80/99 (80.8)	78/92 (84.8)		
	Control	65/82 (79.3)	72/81 (88.9)		
Apr-Jun 2016 (2)	Intervention	53/64 (82.8)			
	Control	68/97 (70.1)			

Table 13 continued.

Quarterly Cohort	Region	18 months N (%)	24 months N (%)	30 months N (%)	36 months N (%)
Jan-Mar 2013 (1)	Intervention	0/1 (0)	16/16 (100)	26/28 (92.9)	22/23 (95.7)
	Control	0/0 (0)	22/27 (81.5)	32/39 (82.1)	31/37 (83.8)
Apr-Jun 2013 (2)	Intervention	0/1 (0)	28/31 (90.3)	35/38 (92.1)	31/34 (91.2)
	Control	1/1 (100)	20/31 (64.5)	28/36 (77.8)	31/36 (86.1)
Jul-Sep 2013 (3)	Intervention	18/25 (72.0)	46/48 (95.8)	41/46 (89.1)	
	Control	28/37 (75.7)	40/44 (90.9)	36/43 (83.7)	
Oct-Dec 2013 (4)	Intervention	37/45 (82.2)	43/48 (89.6)	43/47 (91.5)	
	Control	29/32 (90.6)	37/41 (90.2)	29/33 (87.9)	

Jan-Mar 2014 (1)	Intervention Control	39/42 (92.9) 38/44 (86.4)	32/37 (86.5) 38/41 (92.7)
Apr-Jun 2014 (2)	Intervention Control	39/42 (92.9) 51/61 (83.6)	38/38 (100) 39/47 (83.0)
Jul-Sep 2014 (3)	Intervention Control	41/45 (91.1) 32/36 (88.9)	
Oct-Dec 2014 (4)	Intervention Control	46/54 (85.2) 47/52 (90.4)	

Figure 7. 90-day retention by quarterly cohorts using secondary definition: based on recorded scheduled visits versus actual date of client return

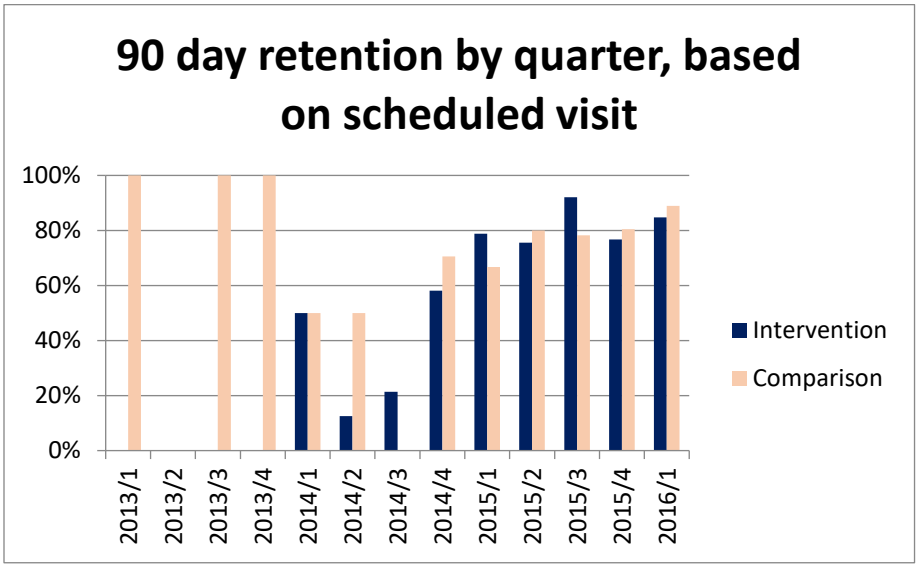


Figure 8. 180-day retention by quarterly cohorts using secondary definition: based on recorded scheduled visits versus actual date of client return

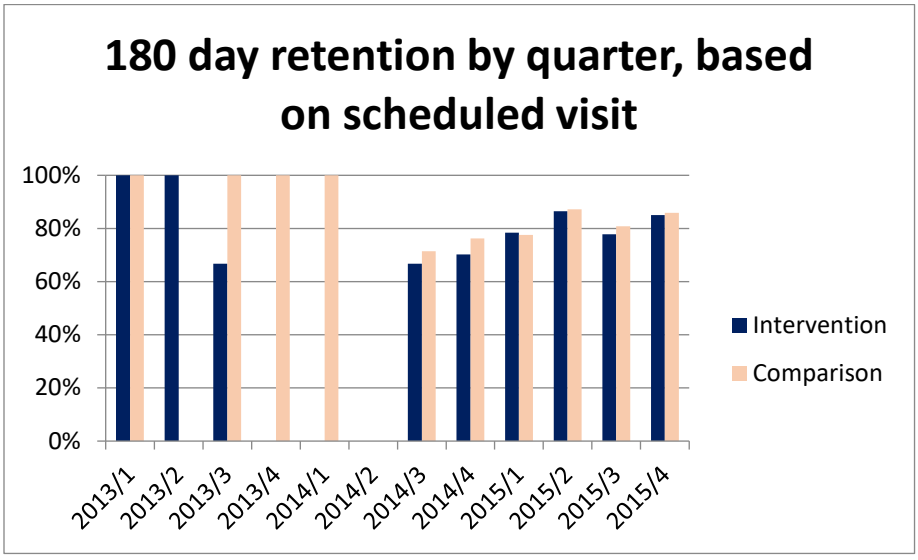
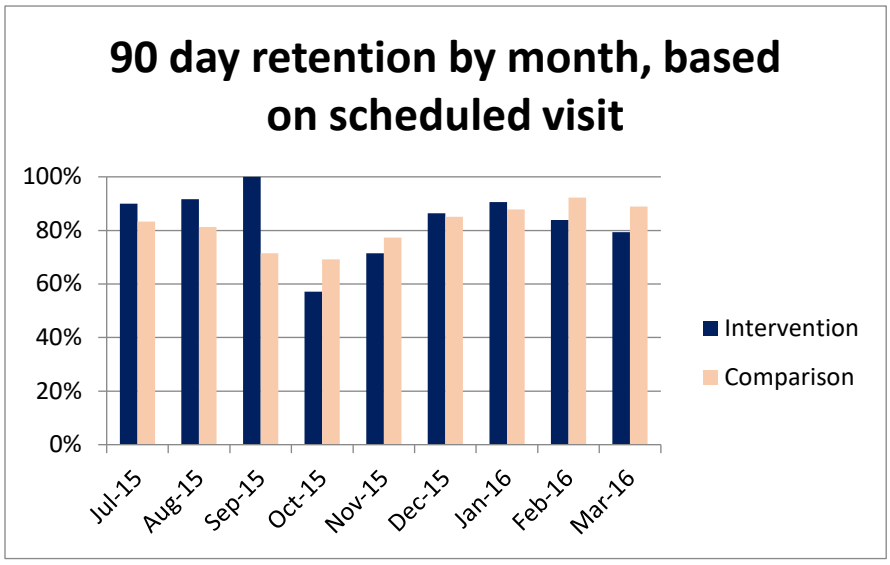


Table 14. Retention in monthly cohorts, based on clinical records: client returning within two weeks of scheduled appointment date.

Monthly Cohort	Region	30 days N (%)	90 days N (%)	180 days N (%)
Jul 2015	Intervention	22/28 (78.6)	18/20 (90.0)	15/18 (83.3)
	Control	10/17 (58.8)	15/18 (83.3)	15/17 (88.2)
Aug 2015	Intervention	12/18 (66.7)	11/12 (91.7)	8/12 (66.7)
	Control	11/21 (52.4)	13/16 (81.3)	13/17 (76.5)
Sep 2015	Intervention	6/7 (85.7)	6/6 (100)	5/6 (83.3)
	Control	13/18 (72.2)	15/21 (71.4)	14/18 (77.8)
Oct 2015	Intervention	5/6 (83.3)	4/7 (57.1)	4/5 (80.0)
	Control	13/18 (72.2)	9/13 (69.2)	10/11 (90.9)
Nov 2015	Intervention	12/17 (70.6)	10/14 (71.4)	10/12 (83.3)
	Control	17/24 (70.8)	17/22 (77.3)	21/22 (95.5)
Dec 2015	Intervention	19/25 (76.0)	19/22 (86.4)	20/23 (87.0)
	Control	28/44 (63.6)	40/47 (85.1)	36/45 (80.0)
Jan 2016	Intervention	29/36 (80.6)	29/32 (90.6)	
	Control	31/37 (83.8)	36/41 (87.8)	
Feb 2016	Intervention	25/31 (80.6)	26/31 (83.9)	
	Control	10/13 (76.9)	12/13 (92.3)	
Mar 2016	Intervention	26/32 (81.3)	23/29 (79.3)	
	Control	24/32 (75.0)	24/27 (88.9)	
Apr 2016	Intervention	11/17 (64.7)		
	Control	16/29 (55.2)		
May 2016	Intervention	19/22 (86.4)		
	Control	29/37 (78.4)		
Jun 2016	Intervention	23/25 (92.0)		
	Control	23/31 (74.2)		

Figure 9. 90-day retention by monthly cohorts using secondary definition: based on recorded scheduled visits versus actual date of client return



Difference-in-difference analysis:
Several sociodemographic and clinical characteristics were imbalanced at baseline between clients included from clinics in our intervention region versus our comparison region. To account for these confounders and to conduct our difference-in-difference analysis, we fit a series of multivariable logistic regression models controlling for the confounders and testing the interaction term between intervention and time period. As shown below, Model 1 for 30-day retention shows that the intervention region has lower retention rate than the comparison region, but that there is a large increase in retention after the intervention implementation date. Importantly, we observed a highly significant interaction in Model 2 for 30-day retention, showing that the OR for after/before in the comparison region was e^0.9449 = 2.6, whereas in the intervention region the OR for after/before was e^(.9449+.5044) = 4.3. We therefore conclude that our difference-in-difference analysis shows that both regions were improving, but the intervention region improved significantly more than the comparison region. In models 3 and 4, we present results for unadjusted and adjusted models of the intervention vs. comparison region; however, other adjusted models including time period did not converge due to small cell sizes.

Table 15. 30-day retention: Logistic regression modeling results to estimate intervention impact using adjusted odds ratio and 95% confidence interval. Clinical data, 1 January 2013 – 30 June 2016

	Model 1	Model 2	Model 3	Model 4
Intervention v. control region	Beta=(-0.453), SE=0.092 OR=0.64 (0.53-0.76)	Beta=-0.554, SE=0.103	Beta=(-0.447) OR=0.64 (0.54-0.76)	Beta=(-1.64) OR=0.19 (0.13-0.29)
After v. before intervention implementation	Beta=1.18, SE=0.115 OR=3.3 (2.6-4.1)	Beta=0.9449, SE=0.161		
Interaction term: region X time		Beta=0.504, SE=0.230		
Marriage				Beta=(-0.046) OR=0.96 (0.78-1.2)
Sex				Beta=(-0.147) OR=0.86 (0.55-1.3)
Years living with HIV				Beta=(-1.14) OR=0.32 (0.09-1.1)

For the 60-day clinical retention outcome (shown below), we included patients with ART start dates through the end of April, 2016. Model 1 for 60-day retention shows that, similar to results for 30-day retention, patients in the intervention region were overall significantly less likely to be retained than patients in the comparison region; however, retention (adjusting for region) significantly improved after the intervention was implemented. In our difference-in-difference analysis shown in Model 2, we tested the interaction term between region and time period to assess any difference between regions in the comparison of before/after. We found in Model 2 that the interaction term was not significant (p=0.72), in contrast to 30-day retention results, indicating that there was no significant impact of the intervention shown between regions in this

analysis. Using the beta estimates from model 2, we calculate that the after/before OR for the comparison region was e^1.11 = 3.0, and the OR for the intervention region was e^(1.11+0.108) = 3.4. Therefore we conclude that for 60-day retention, both regions were improving by similar amounts. In models 3 and 4, we found in the unadjusted model that the intervention region showed lower retention than the comparison region, but in the adjusted model (model 4) we found that this difference was less pronounced after adjusting for marital status and sex. A similar model adjusting for years living with HIV did not converge (results not shown).

Table 16. 60-day retention: Logistic regression modeling results to estimate intervention impact using adjusted odds ratio and 95% confidence interval. Clinical data, 1 January 2013 – 30 June 2016

	Model 1	Model 2	Model 3	Model 4
Intervention v. control region	Beta=(-0.437), SE=0.11 OR=0.65 (0.52-0.81)	Beta=(-0.456), SE=0.12	Beta=(-0.413), SE=0.112 OR=0.66 (0.53-0.82)	Beta=(-0.846), SE=0.357 OR=0.43 (0.21-0.86)
After v. before intervention implementation	Beta=1.16, SE=0.15 OR=3.2 (2.4-4.3)	Beta=1.11, SE=0.21		
Interaction term: region X time		Beta=0.108, SE=0.30		
Marriage				Beta=0.018, SE=0.012 OR=1.02 (0.99-1.04)
Sex				Beta=(-0.037), SE=0.387 OR=0.96 (0.45-2.06)

For the 90-day clinical retention outcome (shown below), we included patients with ART start dates through the end of March, 2016. Model 1 for 90-day retention shows that, similar to results for 30- and 60-day retention, patients in the intervention region were overall significantly less likely to be retained than patients in the comparison region; however, retention (adjusting for region) significantly improved after the intervention was implemented. In Model 2, we test the interaction term between region and time period to assess any difference between regions in the comparison of before/after. In our difference-in-difference analysis, shown in Model 2, we found that the interaction term was not significant (p=0.73), similar to 60-day retention results, indicating that there was no significant intervention impact demonstrated between regions. Using the beta estimates from Model 2, we calculate that the after/before OR for the comparison region was e^1.31 = 3.7, and the OR for the intervention region was e^(1.31-0.118) = 3.3. Therefore we conclude that for 90-day retention, both regions were improving by similar amounts. In models 3 and 4, we found in the unadjusted model that the intervention region showed lower retention than the comparison region, but in the adjusted model (model 4) we found that this difference was no longer significant after adjusting for marital status, sex, and years living with HIV.

Table 17. 90-day retention: Logistic regression modeling results to estimate intervention impact using adjusted odds ratio and 95% confidence interval. Clinical data, 1 January 2013 – 30 June 2016

	Model 1	Model 2	Model 3	Model 4
Intervention v. control region	Beta=(-0.279), SE=0.120 OR=0.76 (0.60-0.96)	Beta=(-0.263), SE=0.129	Beta=(-0.234), SE=0.118 OR=0.79 (0.63, 0.998)	Beta=(-0.179), SE=0.52 OR=0.84 (0.30-2.3)
After v. before intervention implementation	Beta=1.25, SE=0.17 OR=3.5 (2.5, 4.9)	Beta=1.31, SE=0.258		
Interaction term: region X time		Beta=(-0.118), SE=0.349		
Marriage				Beta=0.023, SE=0.012 OR=1.02 (1.00, 1.05)
Sex				Beta=(-0.612), SE=0.515 OR=0.54 (0.20-1.5)
Years living with HIV				Beta=0.023, SE=1.05 OR=1.0 (0.13-8.0)

Propensity score matching

In the propensity score matched analysis, we conducted separate analyses for the three timepoints of 30 day, 90 day, and 180 day retention. For 30, 90, and 180 day retention, we generated a propensity score matched dataset of 178, 234 and 152 clients with valid outcome assessment after the intervention implementation, respectively. 30-day retention showed slightly higher retention rates in the intervention region than in the comparison region, although not statistically significant (70.6% vs. 66.7%, chi-square p=0.58). 90- and 180- day retention rates were slightly lower in the intervention region than in the comparison region, although difference was not significant: 67.9% vs. 73.8%, p=0.33 and 58.8% vs. 66.7%, p=0.33.

Adherence

Pharmacy dispensing registers were analyzed in parallel to the clinical record data to determine medication coverage for study participants as a measure of adherence. Pharmacy data were reviewed for repeated dispensing of ARVs to individual clients who initiated treatment between 1 July 2015 and 30 June 2016. For this 12-month time period, there were a total of 582 clients who were documented to have been dispensed ARVs at least once. Table 18 provides detail per matched facility.

Table 18. Number of clients enrolled into care between 1 July 2015 and 30 June 2016 with at least one visit in the pharmacy register by facility

Control Facility	Total number enrolled n (%)	Intervention Facility	Total number enrolled n (%)
1	24 (7.3)	9	77 (30.2)
2	6 (1.8)	10	16 (6.3)

3		107 (32.7)	11		63 (24.7)
4		60 (18.4)	12		15 (5.9)
5		44 (13.5)	13		15 (5.9)
6		65 (19.9)	14		5 (2.0)
7		7 (2.1)	15		6 (2.4)
8		14 (4.3)	16		58 (22.8)
	Total	**327 (56.2)**		**Total**	**255 (43.8)**

Characteristics of these 582 clients with at least one documented visit in the pharmacy dispening register can be found in Table 19. The control region population was significantly different with regards to religion, marital status, work status, and where referred from.

Table 19. Characteristics among clients initiating treatment between 1 July 2015 and 30 June 2016 with at least one data point in the pharmacy register [a] (see Appendix C for complete table)

Characteristic	Control (n=327), n (%)	Intervention (n=255), n (%)	Overall [a] (n=582), n (%)	p-value
Sex				
Male	85 (28.8)	42 (23.1)	127 (26.6)	0.17
Female	210 (71.2)	140 (76.9)	350 (73.4)	
Years living with HIV				
Less than 1 year	81 (33.9)	43 (31.4)	124 (33.0)	0.84
1-5 years	156 (65.3)	93 (67.9)	249 (66.2)	
More than 5 years	2 (0.8)	1 (0.7)	3 (0.8)	
Age (years)				
15-19	3 (1.1)	2 (1.2)	5 (1.1)	0.99
20-29	43 (15.6)	28 (16.1)	71 (15.8)	
30-49	166 (60.1)	106 (60.9)	272 (60.4)	
50-64	55 (19.9)	34 (19.5)	89 (19.8)	
65 and older	9 (3.3)	4 (2.3)	13 (2.9)	
Level of education				
None	146 (49.7)	86 (47.8)	232 (49.0)	0.98
Primary	78 (26.5)	50 (27.8)	128 (27.0)	
Secondary	58 (19.7)	36 (20.0)	94 (19.8)	
Post-secondary	12 (4.1)	8 (4.4)	20 (4.2)	
Religion				
Christian	184 (67.7)	123 (71.1)	307 (69.0)	0.02*
Muslim	70 (25.7)	28 (16.2)	98 (22.0)	
Animist	7 (2.6)	5 (2.9)	12 (2.7)	
Other	1 (0.4)	1 (0.6)	2 (0.5)	
No religion	10 (3.7)	16 (9.3)	26 (5.8)	
Marital status				
In couple	120 (41.2)	86 (47.0)	206 (43.5)	0.005**
Widowed	49 (16.8)	15 (8.2)	64 (13.5)	
Divorced	36 (12.4)	14 (7.7)	50 (10.6)	
Single	9 (3.1)	2 (1.1)	11 (2.3)	
Separated	77 (26.5)	66 (36.1)	143 (30.2)	
Work status				
Working	165 (87.3)	139 (93.9)	304 (90.2)	0.01*

Unemployed	20 (10.6)	4 (2.7)	24 (7.1)
Retired	4 (2.1)	4 (2.7)	8 (2.4)
Student	--	1 (0.7)	1 (0.3)

[a] Columns may not total to 100 due to missing values.
[b] Exact *p*-values are presented when ≥1 cell is less than 5, where possible.
*=Statistical significance at $p<0.05$; **=Statistical significance at $p<0.01$.

We defined adherence in the pharmacy data based on dispensed medication, and assumed that clients receiving medication completed taking all the medication. If the following pharmacy record occurred before the medication was expected to run out, or within three days following the expected date, then we considered the client adherent and we continued to assume that (s)he took all dispensed medication as intended. Under these assumptions, thirty-day cumulative adherence ranged from 88.3%-100%, although the large majority of monthly cohorts were >90% percent adherent. Sixty-day adherence ranged from 37.5%-76.9% and from 12.5%-61.5% at 90-days by site. At 180 days, adherence ranged from 8.7%-44.4%. No pairwise comparisons within monthly cohorts were statistically significant. Looking at adherence for 30 days, the control region was better in July/August 2015, while the intervention region was better in September 2015-January 2016, and the control region was better in February-June 2016. The control region was better or similar to the intervention region in August through October 2015 for adherence at 60 days, while the intervention region was better for all months between November 2015 and June 2016 except April 2016. At 60 days' follow-up, we observed a fairly clear pattern of the intervention sites improving relative to control sites. Looking at 90-day adherence, the two regions start out very similar, but over time the intervention region shows a pattern of better adherence (not statistically significant) in November 2015-February 2016 (not March or April), and May 2016. Again, the results may suggest that the intervention region N'Zi-Iffou improved relative to the control region of Indénie-Djuablin. We do not see a clear pattern of results over time at 180-day adherence; the control region shows a higher proportion adherent in three monthly cohorts including the first and the last monthly cohorts analyzed. There are several unexpected values that likely reflect random variation and data quality issues. Our ability to assess effect of the intervention will be greater after a longer follow-up period.

Table 20. Dichotomous cumulative adherence by monthly cohort of initiation of ART

Month starting ART	Region	30 days	60 days	90 days	180 days
July 2015	Intervention	25/30 (83.3%)	20/30 (66.7%)	18/30 (60.0%)	9/30 (30.0%)
	Control	18/18 (100%)	12/18 (66.7%)	11/18 (61.1%)	8/18 (44.4%)
August 2015	Intervention	19/22 (86.4%)	10/22 (45.4%)	7/22 (34.8%)	3/22 (13.6%)
	Control	22/23 (95.6%)	16/23 (69.6%)	8/23 (34.8%)	2/23 (8.7%)
September 2015	Intervention	4/4 (100%)	2/4 (50.0%)	1/4 (25.0%)	1/4 (25.0%)
	Control	19/20 (95.0%)	9/20 (45.0%)	5/20 (25.0%)	3/20 (15.0%)
October 2015	Intervention	8/8 (100%)	3/8 (37.5%)	1/8 (12.5%)	1/8 (12.5%)
	Control	15/17 (88.2%)	10/17 (58.8%)	6/17 (35.3%)	3/17 (17.6%)
November 2015	Intervention	17/17 (100%)	13/17 (76.5%)	8/17 (47.1%)	6/17 (35.3%)
	Control	27/28 (96.4%)	15/28 (53.6%)	12/28 (42.9%)	5/28 (17.9%)
December 2015	Intervention	26/26 (100%)	18/26 (69.2%)	13/26 (50.0%)	7/26 (26.9%)
	Control	46/47 (97.9%)	23/47 (48.9%)	16/47 (34.0%)	7/47 (14.9%)

January 2016	Intervention	26/26 (100%)	20/26 (76.9%)	16/26 (61.5%)	8/26 (30.8%)
	Control	37/40 (92.5%)	24/40 (60.0%)	17/40 (42.5%)	8/40 (20.0%)
February 2016	Intervention	27/28 (96.4%)	21/28 (75.0%)	16/28 (57.1%)	
	Control	17/17 (100%)	10/17 (58.8%)	7/17 (41.2%)	
March 2016	Intervention	31/32 (96.9%)	20/32 (62.5%)	13/32 (40.6%)	
	Control	30/30 (100%)	17/30 (56.7%)	14/30 (46.7%)	
April 2016	Intervention	16/17 (94.1%)	10/17 (58.8%)	6/17 (35.3%)	
	Control	27/27 (100%)	18/27 (66.7%)	16/27 (59.3%)	
May 2016	Intervention	22/23 (95.6%)	16/23 (69.6%)		
	Control	34/34 (100%)	19/34 (55.9%)		
June 2016	Intervention	21/22 (95.4%)			
	Control	26/26 (100%)			

Table 21 below shows cumulative percent coverage at 30, 60, 90, and 180 days by region and ART start date monthly cohorts from July 2015 to June 2016. Cumulative percent coverage was found to decrease over time for each monthly cohort. Mean 30-day coverage ranged by region from 0.91-1.00. At 60 days, coverage ranged from 0.75-0.94; whereas at 90 days, it ranged from 0.66-0.92. At 180 days, percent coverage ranged from 0.39-0.83. Among those starting ART in August 2015, a significant difference was observed by region for 60- and 180-day cumulative percent coverage. Specifically, clients in the control region had significantly higher coverage compared with the intervention region at 60 days (0.93 vs. 0.81, respectively) and at 180 days, where coverage was almost doubled (0.69 vs. 0.39) (p<0.05).

Table 21. Cumulative percent coverage by monthly cohort of initiation of ART

Month starting ART	**Region**	**30 days** Mean (SD)	**60 days** Mean (SD)	**90 days** Mean (SD)	**180 days** Mean (SD)
July 2015	Intervention	0.93 (0.18)	0.90 (0.20)	0.88 (0.23)	0.69 (0.40)
	Control	1.00 (0)	0.89 (0.20)	0.88 (0.21)	0.72 (0.41)
August 2015	Intervention	0.97 (0.12)	0.81 (0.22) *	0.73 (0.29)	0.39 (0.46) *
	Control	0.98 (0.10)	0.93 (0.14)	0.83 (0.20)	0.69 (0.34)
September 2015	Intervention	1.00 (0)	0.75 (0.29)	0.69 (0.30)	0.77 (0.33)
	Control	1.00 (0)	0.80 (0.24)	0.66 (0.28)	0.54 (0.36)
October 2015	Intervention	1.00 (0)	0.78 (0.23)	0.69 (0.25)	0.56 (0.38)
	Control	0.91 (0.26)	0.81 (0.27)	0.75 (0.30)	0.72 (0.36)
November 2015	Intervention	1.00 (0)	0.93 (0.17)	0.86 (0.19)	0.83 (0.35)
	Control	0.99 (0.038)	0.83 (0.22)	0.71 (0.34)	0.61 (0.42)
December 2015	Intervention	1.00 (0)	0.87 (0.20)	0.80 (0.24)	0.74 (0.35)
	Control	0.99 (0.073)	0.85 (0.21)	0.79 (0.25)	0.60 (0.42)
January 2016	Intervention	1.00 (0)	0.92 (0.17)	0.88 (0.21)	0.72 (0.40)
	Control	0.96 (0.15)	0.90 (0.18)	0.85 (0.20)	0.68 (0.44)
February 2016	Intervention	0.98 (0.094)	0.94 (0.16)	0.89 (0.19)	
	Control	1.00 (0)	0.88 (0.19)	0.80 (0.24)	
March 2016	Intervention	0.98 (0.088)	0.86 (0.21)	0.76 (0.29)	
	Control	1.00 (0)	0.87 (0.20)	0.84 (0.23)	
April 2016	Intervention	0.97 (0.12)	0.88 (0.19)	0.82 (0.18)	
	Control	1.00 (0)	0.93 (0.16)	0.92 (0.17)	
May 2016	Intervention	0.98 (0.10)	0.90 (0.19)		

	Control	1.00 (0)	0.91 (0.16)
June 2016	Intervention	0.98 (0.11)	
	Control	1.00 (0)	

*p<0.05 comparing regions within monthly cohort for that follow-up period

Looking at successive monthly cohorts over time in pharmacy data, we did not observe any clear temporal trends with adherence rates increasing or decreasing. There was, however, a suggestion of improving adherence in intervention relative to control region. Specifically examining 180 day adherence, in the seven monthly cohorts with sufficient follow-up time to evaluate 180 day adherence, N'Zi-Iffou showed lower adherence than Indénié-Djuablin in three of the first four months (July 2015, August 2015, and October 2015, although only August showed a significant difference), but in later monthly cohorts with 180 day follow-up occurring after the intervention implementation had occurred, N'Zi-Iffou consistently showed higher adherence (November 2015, December 2015, and January 2016). While these differences were mostly not statistically significant, the results are promising for an early impact assessment of the intervention implemented and provide a foundation for assessing longer-term impact going forward.

If we further review the data from N'Zi-Iffou Region by comparing monthly cohort exposure to the intervention based upon the intervention start date of February 2016, we see a difference in mean adherence emerging. For 60-day adherence, only individuals who started ART in January would have had any exposure to the intervention; for the analysis, we consider 15 days of exposure for individuals starting in December 2015, as it is presumed half of the cohort would have initiated treatment in the first half of the month. We consider 'exposure' to the intervention if the cohort was exposed to the intervention for 50% or greater period of time. Table 22 below shows that the mean adherence of the cohort at 60 days was similar regardless of exposure to the intervention (90% no exposure, 92% for exposure at least half of the time period). Similarly, there is no difference in the means of cohorts at 90-days after initiation of ART (88% each); however, at 180 days, the mean adherence is 76% for the three individual monthly cohorts considered exposed to the intervention vs. 60% for the four monthly cohorts without exposure. Although the numbers of cohorts are small, this does perhaps show a trend related to dose of exposure to the intervention. Mean adherence of monthly cohorts for the control region are shown in Table 23. All time periods analysed (60, 90 and 180-day medication coverage) have a lower mean in the control sites compared to the intervention sites, regardless of exposure to the intervention.

Table 22: Mean adherence of monthly cohorts in the intervention group based on exposure to the intervention

Month starting ART	**Days exposure (%)**	**60-day adherence** Mean		**Days exposure** (%)	**90-day adherence** Mean		**Days exposure** (%)	**180-day adherence** Mean	
Jul-15	0	0.90		0	0.88		0	0.69	
Aug-15	0	0.81	**0.90**	0	0.73	**0.88**	15/180 (8%)	0.39	**0.60**
Sep-15	0	0.75		0	0.69		45/180 (25%)	0.77	

Oct-15	0	0.78		0	0.69		75/180 (42%)	0.56	
Nov-15	0	0.93		15/90 (17%)	0.86		105/180 (58%)	0.83	
Dec-15	15/60 (25%)	0.87		45/90 (50%)	0.80		135/180 (75%)	0.74	**0.76**
Jan-16	45/60 (75%)	0.92		75/90 (83%)	0.88		165/180 (92%)	0.72	
Feb-16	60/60 (100%)	0.94		90/90 (100%)	0.89	**0.88**			
Mar-16	60/60 (100%)	0.86	**0.92**	90/90 (100%)	0.76				
Apr-16	60/60 (100%)	0.88		90/90 (100%)	0.82				
May-16	60/60 (100%)	0.90							

Table 23: Mean adherence of monthly cohorts in the control group

Month starting ART	**60-day adherence** Mean		**90-day adherence** Mean		**180-day adherence** Mean	
Jul-15	0.89		0.88		0.72	
Aug-15	0.93		0.83		0.69	
Sep-15	0.80		0.66		0.54	
Oct-15	0.81		0.75		0.72	
Nov-15	0.83		0.71	**0.80**	0.61	**0,65**
Dec-15	0.85	**0.87**	0.79		0.60	
Jan-16	0.90		0.85		0.68	
Feb-16	0.88		0.80			
Mar-16	0.87		0.84			
Apr-16	0.93		0.92			
May-16	0.91					

Qualitative

Four facilities were selected for the in-depth qualitative evaluation funded by 3ie. This inlcuded two intervention sites in the CDC program and two control sites not in the CDC program. In each region, there was one hospital and health centre in each study arm. The implemention of the integrated model of chronic care occurred in phases across intervention sites (N'zi-Iffou). The status at the two intervention sites included in the qualitative evaluation are found in Table 24 below.

Table 24: Timeline of program implementation and qualitative data collection (a)

Program Components		**Hospital**	**Urban Health Center**
Preparation	Provider orientation & training for integrated management of chronic diseases	Aug-15 Feb-16	Aug-15 Feb-16
	Provider training (task shifting) to nurses & midwives on ART prescription	Nov-15	Nov-15
	Provider training on data management	Mar-16	Mar-16
	CHW training on messages for chronic diseases	Apr-16	Apr-16
	Distribution of data collection tools	May-16	Mar-16
	Distribution of materials for project activities (b)	May-16	May-16
Clinic	Appointment card use	Sep-16	Oct-16
	Revised flow for clients with chronic diseases	Mar-16	Jun-16
	ARV prescription by nurses and midwives	Dec-15	Dec-15

	Down referral	Mar-16	Jul-16
	Patient Care Team meetings	Feb-16	Mar-16
Community	Health Club meetings	Feb-16 (c)	Feb-16 (c)
	Home visits (paper-based forms or CommCare)	May-16	Jun-16

(a): Qualitative data collected in first two weeks of May 2016, prior to some component being started.
(b): registers, report cards, telephones, glucometers, BP cuffs
(c): Even though health clubs may have been established in some villages in the catchment areas of the facilities prior to the qualitative interviews, the interviewees may not have been been invited to the groups or may have come from other villages. The interviewees may have also been traveling prior to May 2016 and not heard of the groups. It may take a while for an intervention at the comunity level with a cap of 15 clients to be widely known by all clients at the facility.

A total of 36 qualitative transcripts were analysed from interviews and FGDs combined. We reached two patients in each study group who fit the profile of men and women who missed an appointment, as well as pregnant women before or during ART (Table 25). We interviewed two community counsellors, two nurses, and two pharmacy staff and conducted six focus groups in each study arm. It was not possible to reach any young men or women in the intervention sites. One young man and seven young women for focus groups were reached at the control sites. The majority of respondents in both arms were older men and women.

Table 25: Participants in the qualitative study, Cote d'Ivoire ART retention

Type	Intervention Group	Control Group	Total
Interviews with Clients			
Man who missed an appointment	2	2	4
Woman who missed an appointment	2	2	4
Pregnant women before or during ART	2	2	4
Total Clients	6	6	12
Interviews with Providers			
Community Counsellor	2	2	4
Nurse	2	2	4
Pharmacist/pharmacy staff	2	2	4
Total Providers	6	6	12
Total individual interviews	12	12	24
Number of focus groups	6	6	12
Number of mixed groups (subset)	4	1	5
Focus group participants			
Young men (age 18-23)	unavailable	1	1
Young women (age 18-23)	unavailable	7	7
Older men (age 24+)	17	17	34
Older women (age 24+)	23	19	42
Total focus group participants	40	44	84
Total study participants	**52**	**56**	**108**

Demographic characteristics of participants are found in Table 26, below

Table 26. Characteristics of clients and health providers in the qualitative evaluation

	In-depth Interview	Focus Group Discussion

Characteristic	Intervention N (out of 6)	Control N (out of 6)	Intervention N=40 *Percent*	Control N=44 *Percent*
Participant (Clients)				
Male [Female]	2 [4]	2 [4]	42 [58]	41 [59]
Aged between 25–49	6	6	100	91
Married or living together [Single/Divorced/Widowed]	3 [3]	5 [1]	68 [32]	52 [48]
Children: 3 or less [4–7]	6 [0]	3 [1] (a)	52 [48]	59 [22] (a)
Education: Primary or less [More than primary	3 [3]	4 [2]	68 [32]	66 [34]
Using contraception	0	1	0	16
Provider *(a)*				
Number of years working in ART or HIV care: 0-5 [6+]	2 [4]	2 [4]	n/a	n/a

(a) Two IDI participants were missing on number of children and one is missing on employment. For FGD control site participants, 18% were missing on number of children. In each group, 2 providers were nurses, 2 were community counsellors and 2 were pharmacy staff.

The theme and sub-themes emerging from the qualitative evaluation are presented in Table 27.

Table 27. Themes on the enablers and barriers to ART appointment adherence emerging from qualitative interviews and focus group discussions with clients and providers in Cote d'Ivoire

	Enablers	Barriers
Client-related	• flexibility at the workplace to attend appointments • social support to remind about appointments and taking medicines • self-reliance, meaning client developed own means to remember appointments and taking medicines	• difficulty with disclosure and perceived stigma, including fear of partner's reaction and rejection. • not wanting to be seen at the health facility , including in clinic waiting areas, by others from the community due to perceived stigma. • clients mentioned people with HIV are laughed at and insulted in the community • social responsibilities, including attending funerals and rituals in the home village • influence of traditional healers and practitioners. • lack of roundtrip transport costs and the need to borrow funds from friends or family • travel outside the region for work or for social responsibilities.
Service-related	• provider follow up with clients, including telephone calls • counselling messages that emphasise HIV is chronic condition like others conditions (a)	• Challenges with staff not being available , scheduling of appointments • wait times

	Enablers	Barriers
	• confidentiality assured by providers (a) • clinical care team acting in coordinated way (a) • scheduling of appointments to meet clients' needs • providers' encouragement of social and partner's support to the client	

(a) sub-theme more salient in the intervention sites' transcripts than those of control sites

Service-related enablers included: service aspects facilitating access to medications; provider follow up with clients; counselling emphasizing HIV among chronic conditions; confidentiality; clinical care team and scheduling; and encouragement of social support.

Within the facility, the way that services were set up helped to facilitate access to ART medications. Some participants mentioned getting drugs directly from the nurses and not needing to go to the pharmacy. Nurses mentioned clients being started on ART right away for those testing positive. A pharmacist believed that the community counsellor helped clients come to appointments. The lack of cost for ART and appointments was mentioned as important factor. At the ART service, clients were often able to receive their medications even if they came early or late to an appointment. At an intervention health centre, if a client was traveling outside the region, the community counsellor would call her and reschedule the appointment.

Outside of the facility, the community counsellor sometimes made home visits. Sometimes the providers would call the clients and even brought the medications to the clients. A control group nurse mentioned she had even brought ART medications to a client who had travelled to the capital city, Abidjan. An aspect of delivery care facilitating access was giving clients a choice of the location for receiving ART: clients could choose to go to the nearest clinic to their home or to a hospital. In general, the facilities appeared to have adequate supply of drugs. Overall, clients did not mention having trouble with taking or tolerating medications.

Providers called clients who did not attend the facility within three days after a scheduled appointment. Some providers mentioned wanting more airtime to be able to make calls to patients. Sometimes, providers called clients in advance of their appointments to remind clients of their appointments. Related to counselling, participants had much to say about their own attitudes and those of others related to ART and how living with HIV was perceived. Messages encouraged by the providers were often echoed in the client interviews and focus groups. For example, messages heard were that HIV was a chronic condition and that having HIV was better than other conditions in that the medications were free of cost and that you can live a normal life if taking medications. Some participants believed that other diseases were worse than HIV, such as Ebola, guinea worm or hypertension, which can prevent people from working. When asked to talk about stigma during an interview, a man from an intervention site stated:

“la stigmatisation au fait c’est ça je dis actuellement, y’a des maladies qui sont plus graves que, que comment on appelle le sida. Aujourd’hui Ebola te prend tu meurs, le palu, matin jusqu’au soir si tu n’as eu de traitement [rire] tu, tu t’en vas.”

[stigmatisation, what I’m saying right now, there are diseases that are more serious than, than what we call AIDS. Today, Ebola, if you get it you die, malaria, morning until night if you have not had treatment [laughing], you go away]

Confidentiality of information during services was viewed as being important and maintained at the sites. At a control site, the community counsellor explained how the staff know that information needs to stay within the facility. The ‘professional secret’ is how the providers described confidentiality at both control and intervention sites. The need for confidentiality was discussed at staff meetings. At an intervention site, clients believe the ‘secrets’ are respected. The nurse explained:

“On peut dire que les patients apprécient puisque moi-même je me dis qu’ici c’est l’intimité et la confidentialité donc je m’arrange à ce que le patient soit à l’aise et se dise que c’est nous deux seulement qui sommes dans le bureau et ce qu’on a dit ça reste entre nous. Même si on se croise dehors je fais comme si on ne se connait pas pour qu’il se sente à l’aise….”

[One can say that patients appreciate it considering that I tell myself that this is private and confidential so I make sure that the patient is at ease and thinks that it is just the two of us that are in the office and that it stays between us. Even if we see each other outside, I act like I don’t know them so that they feel at ease.]

The care team of professionals was seen as an enabler to ART adherence. There was a perception that doctors in the hospitals are informed and work with community counsellors and nurses in a good collaboration. At the intervention sites, the team environment was emphasized and the community counsellor believed the clients appreciated the team care. At a control site, the community counsellor had worked for over 10 years and explained that she knew that her role was to complement the work of the nurse and doctor with specific tasks. At the control site, a male focus group participant believed that health providers as State employees were qualified and he had confidence in them. Patients noted that providers took care of them, welcomed and encouraged them, and also, did not insult them.

Improved scheduling of appointments was an enabler. In sites where a calendar was used for scheduling appointments, there was a perception of there being more providers than before and that wait times were reduced. An intervention site focus group client believed that the number of providers was adequate. A male control site focus group client believed the waits were reduced and manageable.

Giving clients drugs for several months was seen as important step towards access to medications and appointment adherence. Clients who came to appointments felt rewarded with receiving three months’ worth of medications. A male client liked to call the clinic ahead of time to confirm his appointment.

A service-related enabler was the encouragement of social support for the client. Each client is asked to name a support person and supply the contact information to help maintain contact. Encouraging disclosure and communication among couples and partners was also mentioned as important. Providers encourage clients to disclose to their partners and support each other to take medications and go to appointments. Sometimes the provider will help with disclosure to the spouse. An intervention site nurse explained the focus on couples and disclosure:

> *"Bon, c'est maintenant on tape dessus ; on est obligé de mettre la pression sur eux sinon au début d'autres préfèrent se cacher. On leur dit non, c'est une maladie, il faut informer quelqu'un pour que toi-même tu sois en sécurité et en paix avec toi. Donc ton partenaire a le droit de savoir, s'il sait il te soutien et tu n'auras pas de problème. "*
>
> *[Ok, now we're on it; we are forced to put pressure on them otherwise at the beginning some prefer to hide. They are told no, it's an illness, it is necessary to inform someone so that you can be good and at peace with yourself. Your partner has the right to know, if they know they can support you and you won't have issues.]*

Male clients recounted disclosing their status to their spouses and a few mentioned that only their spouse knew their status. In terms of community sensitization on topics of HIV, it seemed this was not happening currently although this may have happened in the past, according to providers at an intervention health centre.

Client-related enablers involved flexibility at the workplace, social support, and self-reliance. A few participants mentioned having an employer or school that allowed for time off to go to appointments and others had flexible schedules, although some spoke of losing income and wages while going to appointments. Regarding family support, often clients spoke of having one or more family members including spouses that helped remind them of appointments, accompany them to the clinic, or give transport funds.

Several clients mentioned helpful reminder techniques, such as the appointment date being written in their client booklet. If they did not read, the date could be read to them by a family member. Some clients simply come for their next appointment when their medications run out. One man mentioned that it is not possible to forget an appointment by asserting, "A man's memory is like a computer."

There were some differences between enablers identified by intervention and control group participants. Intervention site participants spoke slightly more about providers working together as a team, the importance of confidentiality and counselling, and framing ART adherence and care for people with HIV as a chronic condition.

Barriers related to retention in care and adherence to HIV treatment

Specific **client-related barriers** were highlighted, and difficulty with disclosure and stigma were salient barriers to adherence. One aspect was fear of partner's reaction and rejection. Several clients had not disclosed their status to the wider family and several had not told anyone. Some feared the gossiping that would ensue should others in the community find out. In a focus group of women at an intervention site, about half of participants had not disclosed their status to their

spouse, their parents or family ("your parents will scorn you"). In the case of a few participants, a family member had discovered the client's status and told others in the community and then the client was ostracized. These quotes illustrate the social difficulties:

- "[My family] abandoned me because they thought I might contaminate them, so I live alone." *—Male client on ART, age 39, intervention site*
- "Now when I make [food], no one buys [it]."*—Female, age 38, intervention site*
- "I have not informed anyone [of my status]…Because for us here, people don't know how to hold their tongues…" *—Male, age 35, control site*

Being seen at the health facility by others in the community was a social risk for clients on ART due to stigma. One client describes how being seen picking up ART drugs or at the facility, especially by community elders, would lead to stigma and shame. Older clients believed that younger ones who saw them at the clinic would also not be able to keep secrets. Clients had concerns about the non-medical staff not keeping information confidential. At some facilities, clients waited in one place to get medications and could easily be seen. Some clients opt to attend clinics far away from home so as not to be seen by people they know, resulting in a more expensive trip. At the facility, clients don't want their name said aloud, according to the pharmacist. Clients worried that others would be talking about them in town. A female focus group participant recounted: "Your heart beats (when you come to the clinic); you don't know who you will come across."

In terms of attitudes, some clients mentioned that in the community, people with HIV are laughed at and insulted. Food prepared by people with HIV is not bought or eaten so there are financial implications of being ostracized, especially for women who prepare food for a living.

Barriers to appointment adherence also came in the form of social responsibilities, including attending funerals and rituals in the home village. A female client mentioned she cannot decline when called by her elders to go to her home area and the family was not aware of her status. These absences can take up to a week and this type of travel ('displacement') was a reason for non-attendance at appointments. A focus group participant at an intervention site asserted, "A good African may miss an appointment due to a funeral in the community".

Another barrier revealed was the influence of traditional healers and practitioners. Sometimes this type of care in the community was received when a person was sick and if living with HIV, before becoming stable on ART. Traditional healers were described as seeking out clients and this appeared to be more acceptable for suspected malaria. Prayer camps were also mentioned as attracting people with HIV. A nurse at a control site explained that some clients will return to the clinic much worse than when they were last seen because the clients will have stopped taking the ART while attending prayer camps:

> " *…les malades, beaucoup aiment visiter les camps de prière. Et donc au moment où ils arrivent, ils arrivent toujours dans un état de sida-maladie….Des fois même, [le client] est sous traitement, et puis, on lui dit d'aller voir les religieux, parce qu'ils vont prier, ça va aller et il s'en va. Il arrête le traitement, c'est ça même qui est plus compliqué.*"

> […those who are ill, many like to visit prayer groups. And so at the moment where they arrive, they always arrive in a state of AIDS sickness…Sometimes, [the client] is on treatment, and then we tell him to go see religious leaders, because they will pray and that it will be fine and they go. They stop treatment, it's this that is very complicated.]

However, many clients mentioned that they had not gone to traditional healers and were sceptical of them.

Sometimes clients aren't able to come for appointments due to lack of roundtrip transport costs and the need to borrow funds from friends or family. Some focus group clients paid up to 3000 CFA round-trip for the public transport. Sometimes providers gave clients transport funds. Clients mentioned having to sell small goods, such as fruit, to earn transport money before coming to the clinic. A female client from an intervention site explained:

> "*Je n'ai jamais manqué de rendez-vous mais des fois, ça décale parce que c'est ça je disais. C'est par manque de moyen. Donc je me débrouille jusqu'à-à quand j'ai les moyens, je viens à mon rendez-vous.*"
>
> [I have never missed an appointment, but sometimes, I am a bit late because this is what I was saying. It's because of a lack of means. So I manage until I can afford it, and I go to my appointment.]

Clients were often traveling outside the region for work or for social responsibilities. An older male client mentioned going to Abidjan and attending clinics there and missing appointments back in the home area. A female vendor was sometimes on travel and did not make it to her appointments. Clients and providers mentioned that when they were working in the fields in agriculture, it was difficult to come to the clinic, especially during planting or harvesting seasons. An older male focus group participant at a control site said it was not always easy to request time off of his functionary job as it was necessary to show proof of having gone to the hospital, reducing confidentiality.

Service-related barriers mentioned included staff and wait times. Several clients stated that sometimes the doctor was not available at the site when the clients arrived. A provider at a control site believed that the health agents and community agents were not paid well enough and needed more 'motivation'. Some providers believed the communities needed more sensitization on health topics.

Clients expect to wait long periods of time if they do not arrive early in the day to the facility. Participants reported not receiving their medications until 10 a.m. even when arriving as early as 6 a.m. In general, respondents indicated they do not like waiting grouped together on benches in front of consultation rooms, to be seen by others. One client mentioned not wanting to get up from the bench to avoid drawing attention to herself. Some women had a hard time attending appointments if they had children who need attention at home; others brought children with them to the facility. Intervention and control sites had mentions of these barriers in relatively equal intensity or frequency.

There were no differences between barriers identified by intervention and control group participants. At the time of this qualitative study, the chronic care clubs for people living with HIV and other chronic conditions to receive their medications appeared to have not yet started or else the qualitative participants were not aware of the clubs. In none of the transcripts did the participants mention an active club. A few clients had heard of clubs happening in Abidjan or outside the project area.

The focus group and interview clients were asked about their health and other health needs to understand how well services were coordinated and integrated with other health services. Generally, participants in the intervention site focus groups mentioned that they had not felt well before but after coming to the health facility, getting tested, and taking medication, they felt better. One participant even noted the return of hearing and vision. Some participants noted that they have other illnesses noting diabetes, hypertension, ulcer and hip problems.

Some intervention site focus group participants noted the importance of going to the health facility. One noted that a community health worker referred him to the health facility due to stomach pain and ulcer and for an HIV test.

In a control site focus group, participants noted that they go to the health facility for medicines, appointments, and when you don't feel well for any illness. A few noted that you don't have to wait for an appointment to go. One mentioned needing to take your children for any concern including HIV. Chronic diseases were not mentioned at either of the two control sites.

In a focus group at an intervention site, when asked about TB, only some participants reported receiving information and/or counselling for TB. Clients were tested for TB when presenting with a cough. A couple of clients reported receiving treatment for cough. In a control site focus group, one participant had been diagnosed with TB and most said they did not receive information on TB.

In the intervention site focus group, many reported that at every visit their blood pressure was taken. Some participants did not receive information about hypertension. A control site health centre referred patients with diabetes and hypertension to the hospital where there were specialists. At intervention sites, providers mentioned that diabetic and hypertensive clients have their own medical record/chart and that some hypertensives were also on ART. Some providers mentioned that documentation of chronic care in medical records had improved in intervention sites. Clients and providers both noted that while ART is offered at no charge to clients, medications for hypertension and diabetes were not free. At an intervention site, the community counsellor said she sometimes bought the drugs for clients' other health needs ("there are even some that I buy their medications").

In the intervention site focus group, some clients reported family planning being discussed. Some also noted that they had already had had their children or couldn't have any more children. Others had a desire for children and discussed this with a provider.

There were some differences in perception of integration of services by intervention and control group participants. Intervention sites reported more attention was given to chronic conditions,

but not family planning, than control sites. Clients from both intervention and control sites identified waiting time and privacy as issues. Both groups of clients also had concerns about out-of-pocket expenses associated with a visit to a facility.

Only participants from intervention sites had recommendations about schedule flexibility and appointment availability and staffing, suggesting especially at the health center, that staffing needed to increase. Participants were asked about whether providers were enough, and some of the participants may have been aware of the attempts in ther intervention facilities to improve scheduling.

Quotes from intervention site participants related to scheduling and appointments:

- “What I like is when the doctor asks what day I prefer. Sometimes they ask which day of the week do you want […] this I like a lot” Intervention hospital focus group
- "Because there are not many of us and because there is a club *[note: participant may have learned about the club from the interviewer’s question about clubs]*, I would like everyone [with hypertension] to have their appointment on the same day." Intervention health center focus group
- This quote suggests that sick clients should be welcomed anytime: "If when you come back from the market you see that your child is shivering. If it's not 7 and this happens at noon, sickness cannot be foreseen. So if you send your child, someone should welcome him. Whatever the time, people should be available to welcome you." Intervention health center focus group

Quotes from intervention site participants related to staffing:

- "If they want, they should just increase [the number of providers]" Intervention hospital focus group
- "the doctor should always be working, and on days when he is not here, there should be someone to replace him" Intervention health center focus group
  “if we could get another doctor, it would be good for substitution. The day that [the doctor] is not here, the new one could be there” Intervention health center focus group
- "In the beginning of the week when there is a large number of sick people. On Monday and Tuesday you can come in the morning and at noon you will still not have seen the nurse." Intervention health center focus group
- "The receptionist is alone; when there are several patients, she is confused. She wants to take care of everyone at the same time, but she can't, so I would like that they send help for her." Intervention health center focus group

Participants offered suggestions to improve several aspects of care: client waiting time, privacy, appointment scheduling, staffing and out-of-pocket expenses.

Clients receiving HIV care integrated into chronic care mentioned two ways to decrease client wait time: blood pressure checks could be streamlined and medications could be picked up directly at the appointment site instead of pharmacies. They also remarked that improvements should focus on Mondays, the day of the week with the highest client flow. In comparison, control site participants believed waiting times were too long: “instead of waiting in line, sitting and waiting […] we should come individually […] take our medications and leave” (control hospital, young female client on ART in focus group). Additionally, they suggested providers spend less time entering information into computers.

Clients at control sites mentioned that the area where medications were administered did not grant clients enough privacy especially because of its location in the facility where people were likely to recognize them. Participants at intervention sites remarked that client privacy was not secure at the time of testing due to there being too many non-clinical staff in the room: “I think the people who perform the tests […] it is them who start rumours […] there are at least three people in the room […] you see, if there’s already three people in the room, it’s too many, too many” (intervention hospital, male client treated for hypertension in focus group).

Participants receiving integrated care had various suggestions to improve appointment scheduling. Some suggested that clients with hypertension should all be given a monthly appointment on the same day to facilitate interaction between clients with a similar condition; this seemed to suggest a chronic care club was needed. Others expressed their preference for having a choice in setting the date of their next appointment: “what I like is when the doctor asks what day I prefer. Sometimes they ask which day of the week do you want […] this I like a lot” (intervention hospital, male client on ART in focus group). Others wished the clinic had more flexible hours of operation, especially in the case of emergencies. Participants also suggested that having additional providers would decrease wait time and hiring more receptionist staff may improve the care offered on busy days.

Participants also made recommendations regarding out-of-pocket expenses. Clients on ART at the control site were unhappy being asked to pay additional unexpected small sums of money at the time of the appointments, which left them feeling embarrassed (it is possible these were informal payments). In comparison, clients at intervention sites suggested simplifying reimbursement processes for hypertension medications and lowering their cost: “all hypertension medications are so expensive, we don’t know what the government is going to be able to do for us, even with our insurance we can’t [pay]” (intervention hospital, female client treated for hypertension in a focus group of both clients on ART and other chronic conditions). A client on ART at intervention site also asked to be warned about medication stock-outs ahead of time so as not to incur unnecessary travel costs associated with coming to the appointment, suggesting stock-outs may have occurred in the past.

Economic costs to PLHIV

In this section, we present early findings on the economic consequences of ill-health amongst PLHIV in study areas in Cote d'Ivoire. Economic consequences of ill-health are broadly conceptualized as including direct (consultation fees, clinical test fees, other service delivery charges) and indirect (e.g., wages lost, transportation, payments to be seen first, etc.) costs. In future analyses, we will additionally explore strategies for coping with illness and its economic consequences, whether internal to the household or drawing on wider social resources (e.g., support from community members or organizations). Collective consideration of the overall magnitude of economic losses, as well as their distribution across a number of key individual and household characteristics, is anticipated to spur discourse on the creation of possible

strategies for reducing the cost of ill-health to PLHIV, and preventing the occurrence of catastrophic health expenditures[38].

Sample population characteristics

Table 28 presents key population characteristics for the sample population included. A total of 317 interviews were completed: 196 (61%) from Urban Health Centres and 124 (39%) from Hospitals. An estimated 62% of respondents were female; 76% were 35 years of age or older; 55% were married or lived together; 34% reported not having had any education; and 44% were shopkeepers or vendor. Among individual health indicators, nearly half of respondents reported having had HIV for more than 2 years and 98% were on ART. Across study arms, significant differences in the educational status and number (mean) of children were observed.

Table 28: Sample population characteristics

	N	**317**	**Intervention**		**Comparison**		**p-value**
			n	% (95% CI)	n	% (95% CI)	
Sex: Proportion female	194	62	105	54 (27-79)	88	46 (21-73)	**0.15**
Age							
<35 years	74	24	33	22 (14-33)	41	26 (17-39)	**0.51**
35-45	133	44	62	41 (30-54)	71	46 (35-58)	
45+	98	32	55	37 (23-53)	43	28 (19-39)	
Marital status							
Live together	121	40	70	47 (36-59)	51	34 (24-4)	
Widowed	19	6	11	7 (3-16)	8	5 (2-11)	
Divorced	9	3	4	3 (1-5)	4	3 (1-7)	**0.18**
Single	103	34	46	31 (20-44)	56	37 (28-47)	
Married	44	15	17	11 (9-15)	27	18 (8-35)	
Other	7	2	1	1 (0-4)	6	4 (2-10)	
Number of children (*mean 95%)*							
	3.04 (2.77-3.31)		*3.49 (3.13-3.86)*		*2.57 (2.20-2.95)*		***0.00***
Education							
None	104	34	64	41 (34-49)	40	27 (18-38)	
Primary	106	35	49	32 (27-36)	57	39 (29-49)	**0.05**
Secondary school or higher	93	31	42	27 (22-32)	51	34 (24-46)	
Primary occupation							
No employment	51	16	31	19 (9-36)	20	13 (7-23)	
Agriculture/ livestock/ fishing	81	25	43	26 (14-44)	38	25 (13-42)	
Shop keeping/ Seller/ Other	25	8	13	8 (4-17)	12	8 (3-17)	**0.86**
Domestic / home maker	46	14	23	14 (6-28)	23	15 (8-25)	
Other	115	36	53	33 (21-46)	62	40 (27-54)	
Duration of time since diagnosed with HIV (mean years)							

[38] Defined as spending more than 40% of their non-subsistence income on health care payments

	3.15			*2.96 (2.38-3.54)*		*3.35 (2.27-4.43)*	***0.51***
2+ years since HIV diagnosis							
	153	*48%*	*79*	*49 (40-58)*	*74*	*48 (37-59)*	***0.88***
Opportunistic infection							
	80	*26%*	*34*	*22 (14-31)*	*46*	*30 (14-53)*	***0.39***

Figure 10 depicts the total, including direct and indirect, costs incurred for the most recent visit to a health facility by study arm. Overall, 143 of 317 (45%) of respondents reported incurring $0.00 cost for care-seeking. Amongst the 174 individuals that incurred a cost, the total mean cost was $6.03 while the median was $1.94. A wide distribution in costs was observed with total costs ranging from $0.32 to $74. Across socioeconomic strata (tertiles), where T1 denotes the poorest and T3 the least poor, mean costs were highest among the T2 income strata at $6.45 versus $1.55 in the T1 and $3.11 in the T3 strata as demonstrated in Figure 11. Given the pull of extreme values, median costs have been presented in tables to follow.

Figure 10: Distribution of direct and indirect costs across study arms

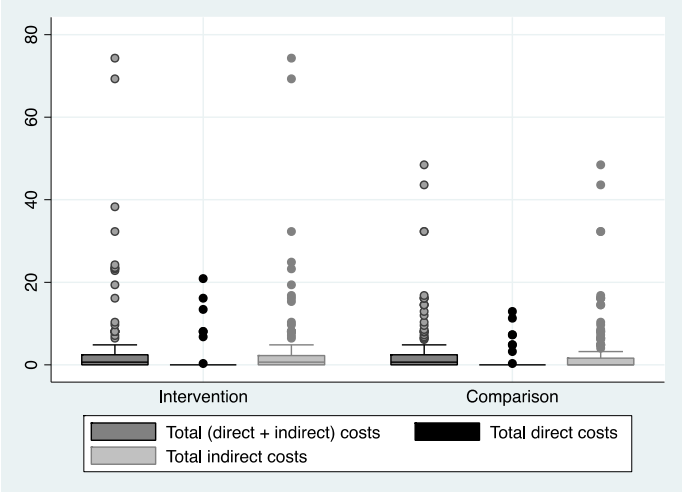


Figure 11: Distribution of direct and indirect costs across socioeconomic strata

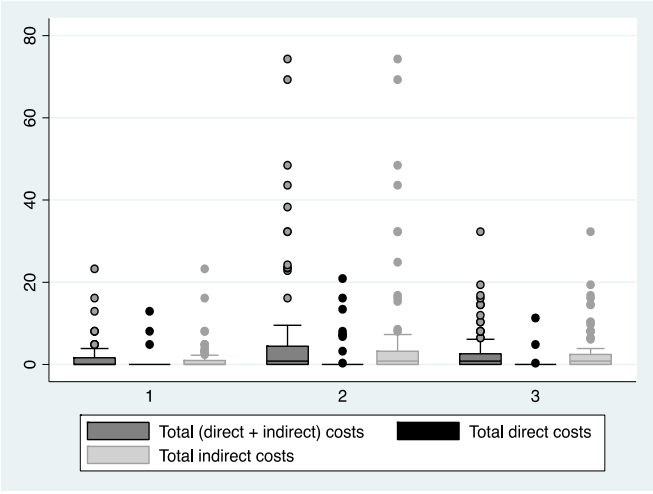


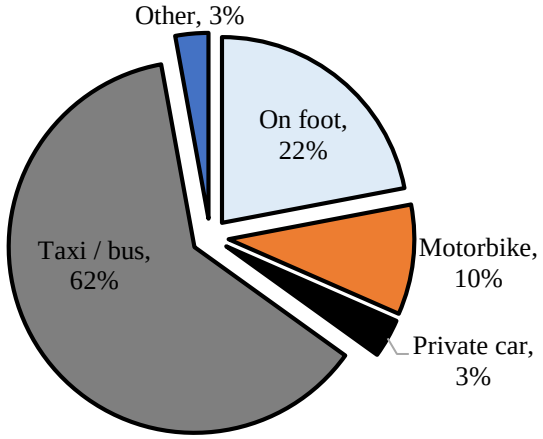
Table 29 summarizes direct and indirect costs underpinning total costs. Median and interquartile range differences are presented for those who incurred a cost as well as the broader sample population. Direct costs were incurred by only 5% of respondents and included consultation fees, other service costs, as well as clinic exam fees. Among the 192 individuals whom reportedly received clinical exams on their most recent visit, 6% incurred costs for blood tests, TB sputum, and/or chest x-rays; while only 3% of respondents reported having had a sputum smear taken and/or a chest rays, the median costs for these individuals were high at $11.20 and $8.07 respectively. When considered across the population at large, median direct costs fall to $0.00 given the infrequency with which overall direct costs were reportedly incurred.

Table 29: Direct and indirect costs incurred on the most recent health facility visit

	Received service		Incurred a cost amongst those who received service		Total cost amongst those who incurred a cost	Total cost across sample population (n=317)
			n	%	Median/IQR diff	Median/IQR diff
Direct costs	**317**	**100%**	**15**	**5%**	**$7.27/$8.07**	**$0.00/$0.00**
Consultation	**317**	**100%**	**2**	**1%**	**$0.32/ $0.00**	**$0.00/$0.00**
Other services	**317**	**100%**	**3**	**1%**	**$6.46/$14.03**	**$0.00/$0.00**
Clinical Exams	**192**	**61%**	**12**	**6%**	**$7.67/$6.46**	**$0.00/$0.00**
CD4 count	*179*	*56%*	*0*	*0%*	*$0.00/$0.00*	*$0.00/$0.00*
Blood test	*68*	*21%*	*6*	*9%*	*$4.04/$7.27*	*$0.00/$0.00*
TB Sputum specimen	*11*	*3%*	*1*	*9%*	*$11.20/$0.00*	*$0.00/$0.00*
TB Chest X-ray	*8*	*3%*	*4*	*50%*	*$8.07/$4.04*	*$0.00/$0.00*
Other	*27*	*9%*	*5*	*19%*	*$4.84/$6.46*	*$0.00/$0.00*
Indirect costs	**317**	**100%**	**174**	**55%**	**$1.61/$4.04**	**$0.65/$1.94**
Transportation			164	52%	$0.65/$1.61	$1.61/$2.58
Wages lost			28	9%	$16.15/$15.75	$0.00/$0.00
Pay to be seen first			6	2%	$0.81/$0.81	$0.00/$0.00
Total direct and indirect costs	**317**	**100%**	**174**	**55%**	**$1.94/$5.65**	**$0.65/$2.42**

Amongst major categories of indirect costs, 52% of the sample population reported incurring transportation costs. Median transportation costs were $1.61 across the total study population. An estimated 62% of respondents travelled via taxi or bus, 22% on foot, and 10% on motorbike (Figure 12). In contrast to transportation costs which were incurred by over half of respondents, only 9% of clients reported losing income as a result of care-seeking. However, amongst those that incurred a cost, the median wages lost were $16.15. Beyond transportation and costs associated with lost income, a small number of respondents (2%) reported paying additionally to be seen first. Table 30 presents data on the median costs by study arm, facility type, and client characteristics, including gender, age, income, socioeconomic status, and occupation. Findings suggest that while median total costs did not significantly differ b study arm, significant differences were observed across socioeconomic strata and by facility type. Among key sub-category costs, median transportation costs difered signficantly by gender, socioeconomic status and facility type. Where the latter is

Figure 12: Mode of transportation



concerned, nearly 75% of PLHIV who sought care in hospitals incurred higher than median transportation costs compared to only 31% in health centers ($p < 0.00$).

Table 30. Median / IQR difference costs by study arm, facility type, and client characteristics

	Total cost			Total Direct			Total In-direct			Transportation			Wages lost		
	Median/ IQR	% greater than median	p value	Median/ IQR	% greater than median	p value	Median/IQR	% greater than median	p value	Median/IQR	% greater than median	p value	Median/ IQR	% greater than median	p value
Study arm			0.30			0.94			0.13			0.14			0.91
Intervention	$0.65/$2.42	48%		$0.00/$0.00	4%		$0.65/$2.26	47%		$0.65/$1.61	41%		$0.00/$0.00	8%	
Comparison	$0.65/$2.42	41%		$0.00/$0.00	5%		$0.00/$1.61	38%		$0.00/$1.61	32%		$0.00/$0.00	7%	
Sex			0.11			0.65			0.06			0.03			0.29
Female	$0.65/$1.61	42%		$0.00/$0.00	4%		$0.65/$1.61	39%		$0.65/$0.81	33%		$0.00/$0.00	10%	
Male	$0.81/$3.23	52%		$0.00/$0.00	6%		$0.81/$3.22	51%		$0.48/$2.26	46%		$0.00/$0.00	6%	
Age (years)			0.33			0.70			0.34			0.40			0.94
<35	$0.65/$1.94	46%		$0.00/$0.00	7%		$0.65/$1.61	45%		$0.65/$1.61	38%		$0.00/$0.00	7%	
35-45	$0.65/$2.42	50%		$0.00/$0.00	5%		$0.65/$1.61	47%		$0.65/$1.61	41%		$0.00/$0.00	8%	
45+	$0.00/$3.23	40%		$0.00/$0.00	4%		$0.00/$2.91	38%		$0.00/$1.94	33%		$0.00/$0.00	8%	
Marital Status			0.49			0.38			0.15			0.07			0.67
Married/live together	$0.65/$2.91	47%		$0.00/$0.00	4%		$0.65/$1.61	47%		$0.65/$1.61	42%		$0.00/$0.00	8%	
Single/divorced/widowed	$0.65/$2.26	42%		$0.00/$0.00	7%		$0.65/$2.58	38%		$0.00/$0.81	31%		$0.00/$0.00	7%	
Education			0.85			0.58			0.72			0.75			0.64
None	$0.65/$2.18	47%		$0.00/$0.00	3%		$0.65/$1.61	46%		$0.65/$1.61	38%		$0.00/$0.00	8%	
Primary or higher	$0.65/$2.91	45%		$0.00/$0.00	5%		$0.65/$2.26	43%		$0.65/$1.61	40%		$0.00/$0.00	6%	
Facility type			0.00			0.00			0.00			0.04			0.34
Hospital	$0.81/$4.44	58%		$0.00/$0.00	10%		$0.81/$3.23	56%		$0.65/$1.78	44%		$0.00/$0.00	10%	
Health Center	$0.81/$1.61	36%		$0.00/$0.00	2%		$0.00/$1.61	35%		$0.00/$1.29	32%		$0.00/$0.00	6%	
Socioeconomic strata			0.00			0.07			0.00			0.02			0.02
T1	$0.00/$1.61	32%		$0.00/$0.00	3%		$0.00/$0.97	29%		$0.00/$0.81	26%		$0.00/$0.00	2%	
T2	$0.81/$4.44	57%		$0.00/$0.00	10%		$0.81/$3.23	55%		$0.65/$1.61	43%		$0.00/$0.00	14%	
T3	$0.81/$2.58	52%		$0.00/$0.00	3%		$0.81/$2.42	51%		$0.65/$1.61	44%		$0.00/$0.00	10%	
Primary occupation			0.17			0.23			0.21			0.35			0.04
No employment	$0.00/$0.86	31%		$0.00/$0.00	4%		$0.00/$0.81	29%		$0.00/$0.81	29%		$0.00/$0.00	0%	
Agriculture/livestock/fishing	$0.00/$1.94	44%		$0.00/$0.00	1%		$0.00/$1.94	44%		$0.00/$1.61	41%		$0.00/$0.00	6%	
Shop keeping/seller	$0.65/$1.61	44%		$0.00/$0.00	12%		$0.65/$1.61	40%		$0.65/$0.81	32%		$0.00/$0.00	8%	
Domestic/homemaker	$0.81/$3.88	55%		$0.00/$0.00	6%		$0.81/$3.23	51%		$0.65/$3.23	47%		$0.00/$0.00	4%	
Other	$0.65/$2.42	47%		$0.00/$0.00	5%		$0.65/$2.26	45%		$0.65/$1.61	35%		$0.00/$0.00	13%	

6. Discussion

This study aimed to evaluate whether an integrated package of chronic care for PLHIV improves adherence to medication and retention in care. The programme interventions were developed based upon known and perceived challenges within Côte d'Ivoire HIV programmes, framed around a theory of change that emphasizes the importance of patient intention and client-provider trust as driving factors for adherence. Fundamental elements of the model of care were implemented by February 2017, including orientation to the model, provider training for integrated management of people living with chronic diseases, training of nurses and midwives on initiating nad management of clients on ART, and establishment of chronic care clubs.

Stigma remains a substantial barrier to PLHIV consistently accessing services[39,40] and the results of the qualitative interviews and FGDs substantiate this. The CDC-funded project aims to address personal attitudes and beliefs, sociocultural norms, and patient self-efficacy through community support and focusing care of PLHIV on the clients themselves, rather than the healthcare system. The project supports the MOH and implementing partners to focus on clients and their families through: providing a minimum package of care to PLHIV and other individuals living with chronic diseases; decentralizing care to the primary point of contact (rural health centres and dispensaries) in order to lessen the financial and time burden on clients; and reinforcing a scheduling system to give clients choices for their care, with the overall aim of organizing services to decrease wait times; and bring care to communities through engaging peers educators to conduct home visits as well as host 'chronic care clubs' in coordination with facility staff.

Our study has several strengths. First, we are evaluating the implementation of a model of chronic care that has been developed in full consultation with relevant stakeholders, most importantly various departments within the MOH. This has fostered ownership of the model by regional and district managers who are responsible for provision of services for the population, and will contribute to the sustainability of the model if it proves to be effective.

The study is evaluating a new, innovative model of care that attempts to 'normalize' HIV like other diseases, as well as increase access to clinical and psychosocial care for people living with other chronic diseases. The selected study sites have adequate heterogeneity, covering both hospital and primary health care facilities with matched intervention and control sites. Finally, our use of mixed methods allows for

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[39] Reda, AA, & Biadgilign, S, 2012. Determinants of Adherence to Antiretroviral Therapy among HIV-Infected Patients in Africa. *AIDS Res Treat, 2012*, 574656. doi:10.1155/2012/574656

[40] Bezabhe, WM, Chalmers L, Bereznicki LR, Peterson,GM, Bimirew,MA, & Kassie,DM, 2014. Barriers and facilitators of adherence to antiretroviral drug therapy and retention in care among adult HIV-positive patients: a qualitative study from Ethiopia. *PLoS One, 9*(5), e97353. doi:10.1371/journal.pone.0097353

a more holistic approach to understanding how best to maintain clients living with chronic disease in life-long care given the complexity of human behavior.

There are several limitations of the study. We had substantial challenges with data collection. There was missing data across all sites, but most notably in control facilities. The results related to client charactersitcis gives evidence of this, whereby there were at least four times as many 'no response' or 'missing' for control sites vs. intervention for sex, years living with HIV, level of education, and religion and twice as many (or more) for age, marital status, and work status.

We had challenges with both RedCAP and Captricity for data capture, and are not confident that pharmacy data analysis included all visits. The period of implementation evaluated was short (6 months), particularly given the complexity of the model as well as the potential for confounding factors in a setting where multiple concurrent programs exist, with various donors and implementing partners.

Côte d'Ivoire has 20 health regions, and we only sampled two in a country with diverse cultural norms and ethnic groups. Additionally, rural health centres and dispensaries, which are important for understanding implementation of the full model of care with a focus on decentralization of services, were not included in the sample size due to the small numbers of clients at this level of facility that were cost-prohibitive from a data-collection standpoint. An additional limitation included the phased approach of model roll out. As mentioned above, not all model components were implemented by February 2016. It is possible that this had an impact particularly on the qualitative and costing components of the project as the small difference was likley due to this.

Quantitative:

In our quantitative analysis, a major strength was our combination of clinic-based and pharmacy-based records to assess retention and adherence in the intervention and comparison regions. We calculated retention in clinical data by comparing the scheduled visit date with the actual return date of each client, obtaining a clear measure of whether and when the clients were returning for ARV visits. In addition, we calculated retention and adherence in pharmacy data based on medication dispensed and medication dispensed at sequential follow-up pharmacy dates. Overall, we observed retention rates increasing substantially over time in both regions. We did not find a strong pattern of significant intervention effects at medium to long-term outcome timepoints. However, we did find a significant intervention effect at the 30-day timepoint in our difference-in-difference analyses of clinic retention, in which the intervention region was seen to have a significantly greater improvement in retention after the intervention implementation, in comparison to the comparison region.

There were several differences in the intervention and comparison regions studied, including years living with HIV, which may be attributed to the fact that the control region of Indénié-Djuablin was one of the first areas in the country outside of Abidjan

to start an ART program. One-in-four clients in the intervention region were newly diagnosed with HIV in the past year compared to 14.4% in the control region. Religion, marital status, and work status were also significantly different across study arms, with a larger percentage of clients being Muslim (28% vs. 14.4%) in the control group, and more individuals citing no religion in the intervention group (9.8% vs 3.5%). A larger percentage of clients were referred from a TB clinic in intervention sites (7% vs 1.8%), perhaps indicating that the TB/HIV integration component of the chronic care model impacted clients enrolled, however further analysis of clinic record data is required.

To better account for differences between regions, we conducted propensity score matched analyses of retention at 30 days, 90 days, and 180 days. Overall we did not find significant differences between regions in these analyses. Retention in the intervention region was slightly higher at the 30 day outcome, and slightly lower at the 90 day and 180 day outcomes.

When comparing characteristics of clients who had pharmacy record data available, there is no longer a significant difference between study arms on number of years clients have been living with HIV, likely due to the fact that national clinical care guidelines changed in February 2015 to provide ART to all PLHIV with CD4 <500 mm^3, expanding access to treatment and increasing the numbers eligible for ART. Religion, marital status, and work status remain significantly different across arms, however, with decreased significance across all three characteristics. The service where the client was referred from remains significantly different with this analysis, whereby two-thirds (64.3%) of clients in control sites were referred through voluntary counselling and testing services or self-referred as opposed to 40% in intervention sites, which may be attributed to poor documentation practices in the control region or the the effect of integration of services as a core component of the project model of care.

The analysis of medication adherence through regular pharmacy dispensing visits does not reveal any statistical difference for any monthly cohort at any period of adherence assessed (30, 60, 90, and 180 days since initiated of ART). Given the time lag needed to assess six-month adherence for six one-month cohorts of clients initiating treatment, it requires at least thirteen months of full implementation of any model of care to be able to analyse if there is any effect of the intervention for six monthly cohorts, which is what the study was powered for. Due to delays in start-up of program implementation and complexity of the model, none of our analysis will afford us the opportunity to look at a full six-month exposure to the intervention of any cohort; with a start date of 1 February 2016, and final clinical and pharmacy data collected 31 July 2016, only one cohort – the individuals who initiated treatment in the month of January 2016 – have five-month adherence data available with 100% exposure. We therefore conducted a review of cohorts by amount of exposure to the intervention (Table 12). The mean six-month adherence rate for the January 2016 cohort in the intervention site was 72% with 92% exposure, compared to a mean of 60% for July 2015-October 2015 cohorts who had <50% exposure demonstrating an

effect of the intervention; however, the variability across monthly cohorts may contribute to this lower mean, as the range of mean adherence at 180 days is from 39% for August 2015 to 69% for July 2015. Our ability to assess possible impact of the intervention will therefore be greater after a longer follow-up period.

In general, adherence to treatment as evaluated through pharmacy data analysis is poor across all sites with an average of 22% 180-day cumulative adherence, assuming more than 3 days without treatment can lead to poor outcomes. Put another way, only one-fifth of all clients had a pharmacy refill documented within 3 days of running out of medications, as determined by previous visits and number of pills dispensed. This is of great concern, as adherence to ART is critical to achieving adequate viral load suppression to minimize the emergence of drug resistance. Poor adherence is a risk factor of virological failure and resistance development in patients without preexisting resistance.[41] Others have used pharmacy refill attendance as a means to measure adherence, and it has been shown to correlate with viral load.[42,43,44] The analysis of pharmacy data has a limitation in that the quality of handwriting in the pharmacy register directly impacted the ability for Captricity to capture the information. Additionally, patient clinic numbers were not written in a consistent manner in registers, whereby digit positions were switched, necessitating additional cleaning of data and additional risks for error.

Overall, our analyses to date provide some evidence of a positive impact of the intervention, in particular the 30-day clinical retention measure. In future analyses, we intend to look at combined data sets between pharmacy registers and clinical records to have a complete picture of retention and adherence, of monthly cohorts in the two arms. We will also conduct time to event analyses for varying time points to estimate retention in order to assess using definitions established in other recent literature.[45,46] Keeping clients enrolled in care and on treatment can and should be optimized by ensuring interventions address the time period between when a person misses and appointment to when s/he is considered 'lost to follow up' and disengaged from care.

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[44] Chalker et al, 2010. *BMC Health Services Research* 2010, 10:43

[45] Rachlis et al.,2016. *BMC Medical Informatics and Decision Making*. 16:52

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Qualitative:

The qualitative analysis sought to determine the primary barriers and enablers to adherence and retention among PLHIV in both the intervention and control regions. Themes emerged for both facilitators and barriers to care. Service-level facilitators included improved access to medications, providers following up with clients, counselling messages emphasizing HIV is a chronic condition, maintenance of confidentiality, presence of a clinical care team, appointment schedules, and encouragement of social spousal disclosure of HIV status.

More than one client mentioned that diseases such as Ebola or malaria can be worse than HIV due to the inability to work. In sites with improved scheduling of appointments, there was a perception of greater staffing and reduced wait times. Overall, intervention site participants spoke more of the service-related enablers. Intervention and comparison site participants mentioned client-related barriers with similar intensity.

Barriers were mainly at the client-level, and were consistent with the findings of other qualitative studies examining adherence.[47,48] These included difficulty in HIV disclosure and stigma, being seen at the health facility by others in the community; the need to skip appointments due to social responsibilities; traditional healers discouraging taking of ART; limited ability pay for roundtrip transport costs to the clinic; and travel outside the region for work or social responsibilities. Service-related barriers were related to staffing and wait times.

Perception that HIV is a condition that can be lived with, similar to other chronic conditions, is articulated by facility staff and clients. The integrated chronic care model has the potential to address many of the mentioned barriers and will improve social support for people living with HIV and disclosure of HIV status among couples. The model may reduce the pervasive perceived stigma that prevents some people living with HIV from adherence to care and treatment. It will also help reduce the transport barrier as patients are able to access care closer to their place of residence. Finally, it should help contribute to improved staffing and wait times

The qualitative evaluation had several strengths. First, different types of participants at different types of facilities allowed for rich information. Providers spoke more about the enablers to ART adherence at the service level. Both clients and providers discussed barriers. Second, discussions occurred at the facility in a room allowing for privacy, confidentiality and respite from the tropical heat and humidity for the one to two hour-long discussion. Third, interviews were carried out by an external, trained, professional team of interviewers from the same regions in Cote d'Ivoire allowing for phrases in the local languages to be understood. There was efficient data collection

[47] Reda, AA, & Biadgilign,S, 2012.
[48] Bezabhe, WM, Chalmers L, Bereznicki LR, Peterson, GM, Bimirew, MA, & Kassie, DM, 2014.

with all transcripts produced within six weeks. Last, the team used a systematic qualitative data analysis approach based on grounded theory.[49]

Several limitations are acknowledged for this portion of the evaluation. First, having the discussions at the facility may not allow for critical information to be mentioned of the services. In addition, the sampling was based on clients that could be reached by phone and who could come to the facility and therefore, our qualitative data would not present the viewpoints of clients who dropped out of services. This limitation was mitigated, however, by the fact that providers did speak about clients who no longer came to facilities. Also, the collection of qualitative data after an initial period of program implementation allowed participants to speak about only the early effects, not the full effects, of the intervention. Control sites may have also had other influences beyond the effects of the Jhpiego-supported program. All sites had the ongoing intervention of the HIV implementing partner. Finally, due to the in-depth nature of the qualitative study, only four sites were selected; however, additional sites may have offered additional insights to the program effects that exited in various contexts.

Economic costs to PLHIV

This analysis sought to provide critical insights into the magnitude of and distribution of economic losses associated with care seeking for PLHIV. The initial CEA planned at baseline was not possible due to budget limitations and time of implementation of the intervention at period of the phone survey.

Across a population of 317 respondents, 45% reported not incurring any costs directly or indirectly associated with care seeking. This is important because it highlights the effectiveness of efforts on the part of the Government of Côte d'Ivoire to expand access to critical HIV services, including drugs and clinical testing, within exacting an economic burden on a large proportion of the population. That said, 55% of respondents did incur a cost – predominately related to transportation to and from clinics. This finding highlights the importance of understanding the consequences of indirect costs to households. Studies have shown that transport costs can be a major barrier to treatment.[50,51] The timing of this survey early on in the implementation of the program meant that many of the community based activities which are likely to improve access to ART and therefore reduce transport costs had not yet started. We envision that later rounds of this survey will demonstrate a favourable reduction in these costs to households.

Beyond the implications of transportation costs, we note that a small proportion of respondents (5%) reported incurring direct costs associated with care and/or other indirect costs, namely a loss of income attributed to the time spent having to seek care. The former was comprised primarily of out of pocket payments for clinical tests

[49] Ritchie J, Lewis J, Nicholls CM, et al, 2013.
[50] Reda, AA, & Biadgilign, S, 2012.
[51] Bezabhe, WM, Chalmers L, Bereznicki LR, Peterson,GM, Bimirew,MA, & Kassie,DM, 2014.

associated with blood work and/or TB identification. While only 11 respondents incurred any costs related to TB (3% of the total sample), the magnitude of costs incurred amongst those that did were not unsubstantial (median $11.20 for sputum, $8.07 for a chest x-ray). While the small numbers negate further analyses beyond descriptive, these findings nevertheless re-inforce the need to consider the full spectrum of chronic diseases and their associated costs and consequences across study populations. With regard to indirect costs, we expected to see a larger proportion of individuals reporting the loss of wages than the 10% (n=28) observed. The lower than expected proportion incurring wages lost may be due to reporting biases around costs, particularly in assigning a monetary value to a day's work as a shop-keeper/ vendor (8% of the population), farmer (25%), or domestic / homemaker (14%).

This portion of the evaluation has a number of limitations. Sample size and demographic variability of respondents did not allow for further disaggreged analysis. Our sample population was drawn from individuals who sought care and consented to be interviewed by our study team. This is likely to have resulted in selection biases not only in that we are missing individuals who did not seek care but that we are further sampling amongst those with mobile phones and willing to participate. While it remains impossible to quantify the differences in these populations, one might hypothesize that the PLHIV not recruited from health facilities and /or without a mobile phone might have differing social and economic profiles than the population reported herein.

Beyond possible selection biases, we note that the format choice for survey implementation might have led to reporting biases, particularly for household characteristics and other assets used to derive socioeconomic indices which are typically gathered through in-person observations. Apart from these indicators, it too is possible that responses may have differed in a face to face survey versus over the phone as obtained here. That said when asked which format they preferred, 75% of respondents indicated a preference for the phone survey versus a face to face interview. The reasons for this preference included a feeling of anonymity, and ease of interview burden in that individuals could specify the time and day preferences for conducting the interview. Many also reported that being interviewed following care via an exit interview extends the overall time and thus opportunity costs of care seeking.

As our analyses continue, we anticipate conducting multivariable analyses into the determinants of transportation costs and in particular, differentials in the magnitude of these costs across key population groups. Bivariate findings suggest that there are significant differences by gender, facility type, and socioeconomic strata. Understanding the reasons for these will be important for informing programmatic activities, particularly at the community level, as we move forward. Beyond these analyses we will explore data on the reported strategies for coping with illness and its economic consequences, whether internal to the household or drawing on wider social resources (e.g., support from community members or organizations). Finally,

we aim to aggregate reported costs not just for the most recent visit but for a larger analytic time horizon of one year to obtain a broader estimate of the costs incurred on an annual basis for PLHIV.

Appendixes:

The appendixes for this report are available online:

Appendix A – Study instruments can be accessed here

http://www.3ieimpact.org/media/filer_public/2018/01/22/tw706-appendix-a-study-instruments.pdf

Appendix B – Power calculations can be accessed here

http://www.3ieimpact.org/media/filer_public/2018/01/22/tw706-appendix-b-power-calculations.pdf

Appendix C - Tables can be accessed here

http://www.3ieimpact.org/media/filer_public/2018/01/22/tw706-appendix-c-tables.pdf

Appendix D – Qualitative themes can be accessed here

http://www.3ieimpact.org/media/filer_public/2018/01/22/tw706-appendix-d-qualitative-themes.xlsx