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Comparative Assessment of Targeted and Non-targeted HIV Testing Service Approaches amongst Youths in Nigeria

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The Netherlands

TITLE: Comparative Assessment of Targeted and Non-targeted HIV Testing Service Approach amongst Youths in the selected state of Nigeria.

A thesis submitted in partial fulfilment of the requirement for the degree of Master of Science in Public Health by Severe Musili R.E; Nigeria

Declaration:

I, Musili R.E Oshevire, hereby declare that this project was carried out, written, and completed by me. This work is original, it has not been submitted for review or publication in any journal. Where other people's work has been used (either from a printed source, internet, or any other source) this has been carefully acknowledged and referenced in accordance with Departmental requirements

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Signature

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Remain Blessed!

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Glossary

AIDS Acquired Immune Deficiency Syndrome
B Coefficient
BCC behaviour change communication
BCC Behaviour change communication
CBO Community based Organization
CI Confidence interval
CTs Counsellor Testers
DHIS2 District Health Information system 2.0
DSD Differentiated service delivery
FSW Female sex workers
GF Global Fund
GIS Geographic Information System
HIV- Human Immunodeficiency syndrome
HMIS Health management information system
HTS HIV testing services
IGA Income generating activities
ITSA Interrupted time series analysis
KII Key informant Interview
KIT Royal Tropical Institute
KP key populations
LMIC low -and-middle income countries
MSM men who have sex with men
NAIIS National AIDS Indicator and Impact Survey
NFM New funding module
NGO Non-Governmental organizations
PEPFAR President's Emergency Plan for AIDS relief.
PNS Partner Notification Services
PWID people who inject drugs
SFH Society for Family health
SRHR Sexual Reproductive Health & Rights
SSA Sub-Saharan Africa
SSA Sub-Saharan Africa
SSA Sub-Saharan African
STI Sexually transmitted infection
TOC Theory of Change
UNAIDS Joint United Nation commission program on HIV AIDS
WHO world health organization
YFHS Youth friendly health services

Definition of Key terms

HIV- (Meaning) Human Immunodeficiency Virus, is a virus that attacks and weakens the human immune system, and can eventually lead to AIDS if untreated. (1)

Youths- Are people within the age of 15-24 years. They are a mix of adolescents (15-19 years) and young people (20-24 years).(2)

key populations: are defined as people in the population at higher risk of HIV. This group of people are disproportionately affected in all locations and epidemic types. E.g sex workers, transgender people, men who have sex with men and people who inject drugs (1)

Mixed epidemics: is a situation when people are getting a HIV infection in one or more subpopulations and in the general population. When one or more concentrated epidemics, within a generalized epidemic happens, it is called a mixed epidemic. (1)

HIV incidence "is the number of new people getting a HIV infection over the number of people susceptible to infection in a specified time period". (1)

HIV prevalence " refers to the number of people living with HIV at a specific point in time. It is expressed as a proportion of the population". (1)

Differentiated service delivery or targeted HTS: differentiated care is a client-centred approach, that simplifies and adapts HIV services across the cascade of HIV care, to reflect the preferences and expectations of various groups of People living with HIV.
The strategy is aimed at reducing unnecessary burdens on the health system. By providing targeted testing, by removing access barriers for clients to uptake HTS. It also reduce the burden of providing services on the healthcare workers.(3)

ABSTRACT

Title: Comparative Assessment of Targeted and Non-targeted HIV Testing Service Approaches amongst Youths in selected states of Nigeria.

Introduction

HIV testing service (HTS) uptake and new positive case finding amongst Nigerian Youths is a challenge despite accounting for 38% of the country's new infections. Their HIV risk level by age and sex are also unclear. This study aims to assess the effectiveness of a HTS project, implemented by the organization-SFH, in a non-targeted and targeted approaches in Nigeria.

Methodology

A mixed method quasi-experimental study of secondary data. Stata16 was used for an interrupted time series, trend analysis of HTS uptake and positivity yield. Analysed at project and state levels, before (2016-2017) and after (2018-2019) intervention. Comparism in Akwa-Ibom, Abuja and Oyo states. Six key informants were interviewed to explore reasons for the trends.

Result

At project level, increased testing *(B:189 CI;61.5-318.0; p<0.005),* positivity yield *(B:13 CI;6.5-20.5 p<0004)* were statistically significant, amongst females 20-24 years post-intervention, in Akwa-Ibom. Abuja and Oyo were not statistically significant in post-intervention. At state level, increased testing was most statistically significant in Oyo. Increased positivity yield was most statistically significant amongst females 20-24 years in Oyo *(B:60 CI;24.0-97.0 p<0.01),* Akwa-Ibom *(B:27 CI;26.4-28.5 p<0.00*), Abuja *(B:16 CI;7.0-25.7 p<0.01).*[1]

Discussion

The finding showed that targeted approach had effect on HTS outcomes. Trend at state level confirms that the intervention can be attributed to the increase. Profiling youth's behavioural risk factors and mapping of social hotspots, that predisposes females to HIV, was effective for mobilization.

Conclusion

Targeted HTS approach amongst youths can be effective in new cases finding, but assessment of impact and cost effectiveness are recommended for scale up.

Keywords**:** HIV, Testing, Youth, Targeted, Positivity yield.

Word count**: 12,964**

[1] CI: confidence interval, B: Coefficient

INTRODUCTION

Nigeria experiences a double burden of disease which is characterised by high infectious diseases and non-communicable Diseases(4,5). In recent times, there is an increase in new HIV infections amongst youths (6,7), despite the effort to increase behaviour changing communication (BCC) and HIV testing service (HTS) (8).

Having worked as a disease prevention officer in Nigeria for 6 years, youth have always been my priority population. I have worked in providing them with BCC intervention and linking them to HTS and treatment services. I have also worked in action research, that explored factors pre-disposing adolescents and young women to HIV infection. Although my experience provided me with the immediate outputs, to track programme progress and objectives; I never fully understood to what extent the HTS approaches improved uptake and positivity yield at state level.

I am interested to know if using this pre-disposing factors, to target female youths, for HTS uptake, improved uptake and gave a positivity yield. To do this, I intend to evaluate a project executed by the Society for Family health, amongst female adolescents, to answers this research question.

This thesis will help me evaluate the effect towards making recommendations to the government and donor agencies, for improved programme design. This evidence is strategic for achieving the first component of UNAIDS vision 95:95:95; which aims getting 95% of all HIV positive persons tested and know their result by 2030.

CHAPTER 1- BACKGROUND

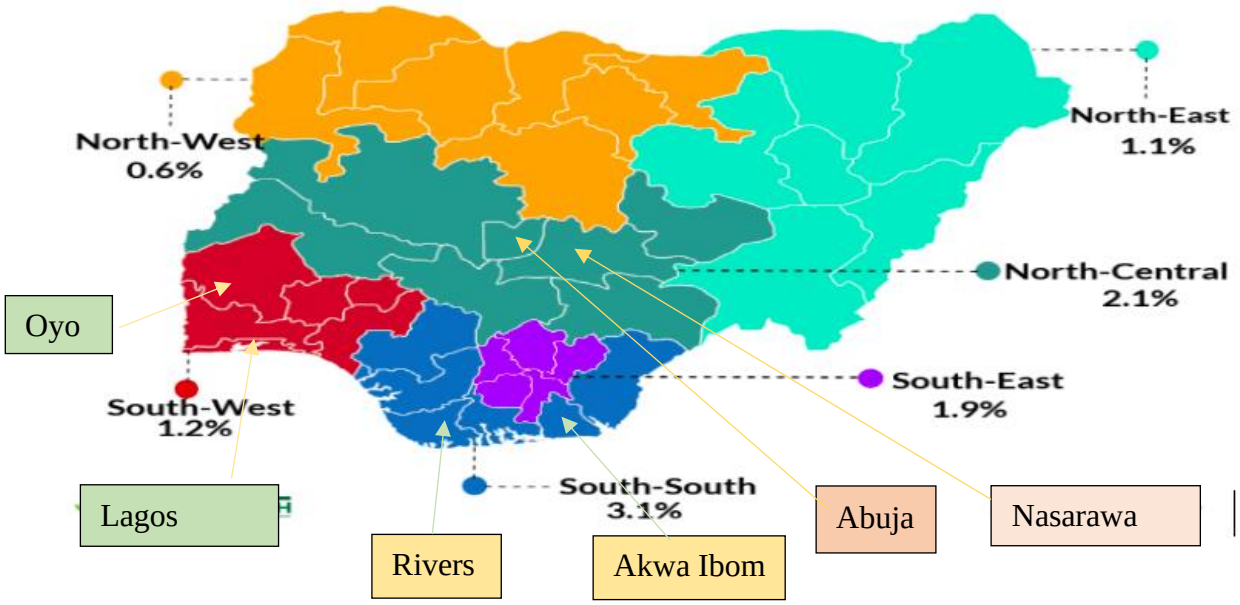
1.1 Demography of Nigeria

Nigeria has a 923,768 km2 land mass and is the most populous country in Africa. (9) The population is estimated over 200 million citizens. The country is considered young with a median age of 18 years. (10) Youths of 15- 24 years constitute 38% of the population. (11) Over the years, the country's economy is one of the best in Africa with a Gross Domestic Product of over $502 billion. (12) Over dependence on crude oil, as its main source of revenue, makes it vulnerable to external shocks, such as inflation. (13) This contributes to the fact that about 40% Nigerians are considered poor. (14) In contrast, there is a gain in the literacy rate and life expectancy of adults above 15 years. (9) Currently, Nigeria ranks at 158 out of 189 countries for the Human Development Index, which is a factor of slow progress in knowledge, life expectancy and poverty rate. (15,16)

1.2 Geo-political zones and HIV prevalence

There are 6 geopolitical zones and 36 states in Nigeria. Due to rapid urbanization, more than half of its population are living in urban areas. (16) The HIV epidemic is characterised as mixed, because prevalence is about 1.5% in the general population, and more than 5% in key population. (1) Nationally, many interventions and improved documentation has contributed to the decreasing figure in prevalence of 3.4% in 2012 to 1.4% in 2018. (17,18) Amongst youths, females of 20-24 years prevalence of 1.3% is reported, which is 4 times the male prevalence. The highest prevalence amongst youths is in south-south at 4.3%. (17)

Figure 1: HIV prevalence amongst persons age 15-64 years by geopolitical zones



Source: National AIDS Impact and Indicator Survey (NAIIS); 2018. (17)

In Figure 1, the 36 states are represented and clustered by colours, based on geopolitical zones. The zonal HIV prevalence is highest (3.1%) in south-south and lowest (0.6%) in North-west. (17) The HIV prevalence of all states generally reduced over the decade. (17,18)

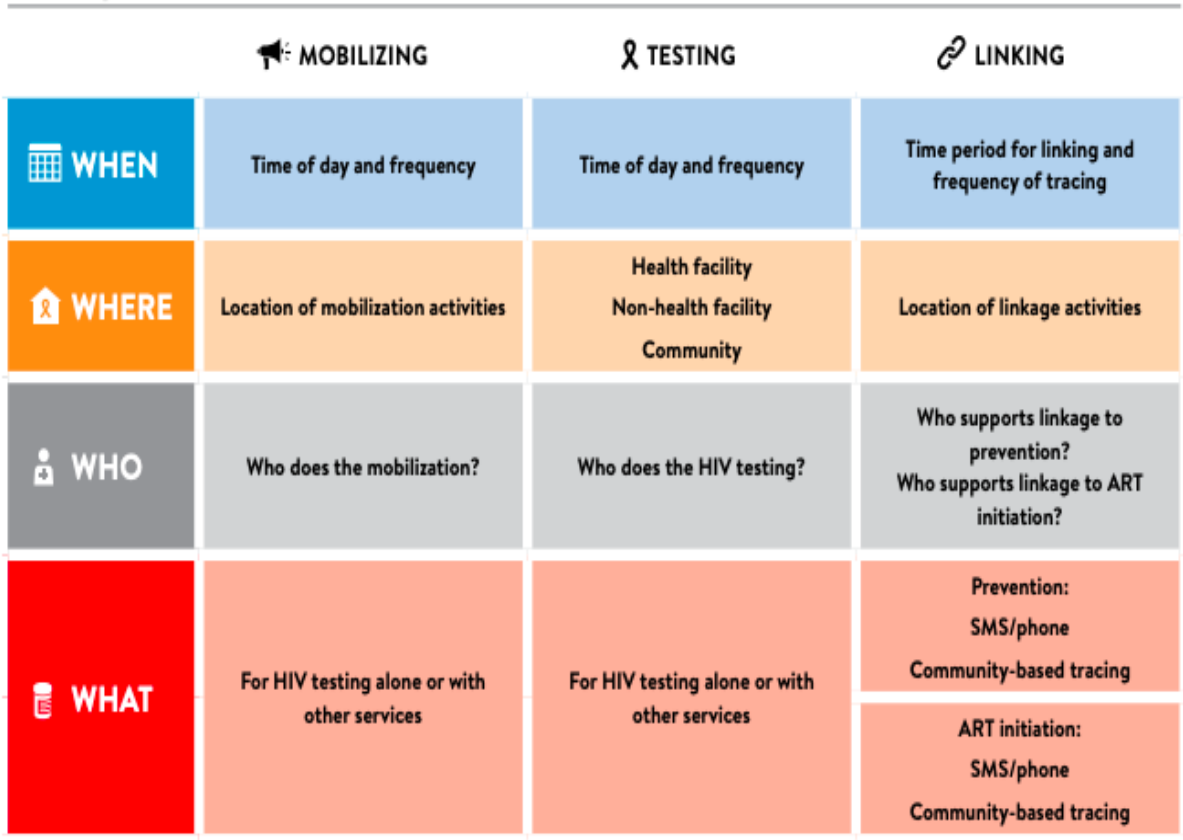
1.3 Overview of Health system

Nigeria operates a federal system in three tiers; Federal, State and Local Government Areas. (19) The health system has primary, secondary, and tertiary levels of care and is interlinked by a two-way referral system. (20) The informal sector is large, owning about 38% of the health facilities. (20,21) The health budget is mainly financed by tax revenue but 70% of the total health expenditures is paid out-of-pocket. (22) The Government Health Expenditure, as a proportion of General Government Expenditure, has always been below the 15% Abuja consensus benchmark, agreed in 2000 by African government for allocation to health.(22) The weak health system is also a factor of poor governance, corruption, inadequate work force, infrastructures, amenities, funding and management within the government. This has contributed to the delay in health system progress towards universal health coverage. (8,23)

1.4 HIV testing service delivery

In Nigeria, HIV Testing Services (HTS) funding comes majorly from international donor agencies (10). Consequently, HIV testing, treatment and care is free in most part of the country (9). There are about 4 different route of service delivery. Facility-based, aims at walk in clients, but is complimented with provider-initiated testing e.g for pregnant women and others. There are also community outreaches aimed at the key population, and far to reach areas. This is done in markets, bars, recreational centres etc. In addition, differentiated approach, otherwise called targeted HTS, is used in the community. Additionally, self-testing is gradually being encouraged (3).

Figure 2: Components and building blocks for HIV Testing services delivery Model



Source: International AIDS Society (IAS) and World health Organization (WHO),2018. (3)

The differentiated care framework contextualizes strategies for mobilization, testing and linkage of people to HTS and treatment in a targeted approach. In figure 2, the model illustrated has been used to target high risk population; female sex workers, men-who have sex with men, and people who inject drugs. It is effective in improving uptake of HTS and HIV positivity yield without exacting too much pressure on the health system and workforce. (3,7) Evaluation of the effect of this innovation has been very scarce amongst youths in Nigeria, but in South Africa, improvement in positive case findings was documented by Kenyon et al. in 2016 (24). It was also successfully used to improve HIV testing among men in Madrid Spain in 2014. (25)

1.5 Problem Statement

HIV remains a public health problem in Nigeria.(26) There is a low uptake of HTS amongst adolescents and young person. (20,26) Young people are most affected, because of early sexual debut, horizontal & vertical transmission and high HIV incidence rates across Sub-Saharan Africa. (26,27) In Nigeria, the low HTS uptake amongst youths, makes prevention, linkage and care impossible and that is why it is a problem. (28)

With a 5% reduction in new infections, from 2017 to 2010, Nigeria still had an estimated 338,000 new infections in 2017 of which 38% were within 10-24 years. (7) The UNAIDS report shows that about 1.9 million Nigerians are living with HIV and only 67% of them know their status in 2018. (25) Despite the declining prevalence within the general population, HIV prevalence among adolescents 15-19 years is still as high as 4.3% in South-South zone, which is higher than the national prevalence of 1.4%. (17) In recent times, national health strategic plans includes young people as a priority group for HIV prevention and care services (29), because of the high undiagnosed HIV infection adolescent and young person compared to adults. (29,30)

Females youths are disproportionately affected; as prevalence is 1.3% amongst 20-24 years. This is 4 times the prevalence in males 20-24 years. (17) Even in the general population the trend is the same, as the highest prevalence is among females aged 35-39 years (3.3%). This is consistent with the global pattern, as studies have shown twice, increase of HIV burden among females adolescent and young people, compared to males. (27,31) A recent study of nationally representative data, reported 23.7% youths had ever tested for HIV. The proportion that had tested, in the year preceding the survey, was lower at 12.4%. For those that never had a HIV test, they were 20.8% males compared to 25.4% females. (32) This progression is slow and has a great implication for achieving the UNAIDS first vision 90, which states that 90% of person living with HIV should access testing and know their HIV status. (8,28)

Another study by Nwaozuru et al 2019, reported that among 113 youths of 14-24 years, about 24.8% of the participants had ever had HTS in their life. (25) Additionally, Ajayi et al. 2020 in a study among Nigerian youths shows that only 23.7% of the respondents had ever tested for HIV and just 12.4% had HTS within 12 months prior to the survey. (33) Nationally, the NAIIS 2018 showed that 60.4% women and 70.8% men had ever accessed HTS and know their status. (17) The sex disparity is worrisome as it affects youths also. Considering the average

age of sexual debut, at 17 years for females and 21 years for males, this increases the chances for female adolescents to contracting HIV. (9)

Another perspective to this findings, people who were at higher risk of contracting HIV may not constitute the majority of people reporting to have accessed HTS (6,8,34). HTS and counselling being the critical first step in accessing HIV treatment and prevention services. (35,36) In the presence of incorrect and inconsistent uses of condoms by unknown HIV positive persons, the virus will still be transmitted in the population regardless of mass testing. (34) In addition, risky behaviours are often developed during adolescence and HTS is an opportunity to engage this age group, including the need to find those who test HIV negative, in order to promote healthy sexual practices, through counselling and linkage to other health services, such as STI treatment, circumcision and contraception. (8,28)

Its plausible to state that transactional sex contributes to the prevalence amongst youths. In Tanzania, an ethnographic study reported poverty, peer pressure, financial and social capital, as the reasons for engaging in the act. (37) Chikwari et al (2018), also alluded that substantial individual, health systems and legal factors affect HTS uptakes, among adolescents in SSA, while stigma by providers and communities remains an important obstacle. (38) Also, Gombe et al 2018, identified some of the barriers to HIV testing, among Zimbabwean adolescents. These included not knowing where to get tested, low risk perception, never having been offered a test, fear of a positive result, being embarrassed by healthcare workers, lack of confidentiality of services, lack of parental consents and parents who will not allow it and unaffordable consultation fees.(33)

In Nigeria, HTS among adolescents was reported to have been influenced by their age, marital status, educational attainments, and socio-economic classes of their parents. (33,39) More important are the prevailing socio-cultural factors and the existing gender inequality in most Nigerian communities.(9) A study by Ogbona et al. 2016, revealed polygamy, child marriage, widowhood rights and multiple sexual partners as the main socio-cultural factors driving HIV epidemiology in Nigeria (40). Gender disparities, in access to education and employment, also increases females risk factor to HIV. Only 53% of Nigerian women are primary school literate, compared to 70% of their male counterparts. (9)

The problem is more acute in rural and northern Nigeria, where most parents of the adolescents live below the poverty line. (14) The poor economic power of most women places them at a disadvantage, to negotiate safe sex and insist on condom use during sex, especially with someone of unknown HIV status. (37) Other biological factors reported to also influence acquiring HIV is presence of other STIs. The physiology of the vagina is prone to trauma, especially during aggressive sexual activities.(41) A study supports this hypothesis in an increase of 4.3% to 23.3% prevalence rate of hepatitis C in Nigerians, in which the majority were young people.(42) In increase in sexual violence amongst young Nigerian girls was reported in 2020, . About 700 rape cases were recorded. (43)

All these factors inter-relate to influence the health outcome of the youths. To contribute to addressing these factors, the organization; SFH, implemented a HTS project amongst female youths in Nigeria. The organization has generated data (targeted approach versus non-targeted approach) and I will be analysing this data to find out which approach is best at increasing the HTS uptake and new HIV-positive yield in the priority population.

Background information of SFH and the HTS project

The Society for family health (SFH) is a non-government Organization (NGO) providing sexual and reproductive health and right (SRHR) services in Nigeria. They have been a principal recipient of the Global Fund (GF) NFM grant for more than a decade. The funding was aimed at providing Behaviour Change Communication (BCC) amongst the key population (MSM, FSW, PWID), and general population with HIV testing services (HTS) in a community participatory approach.

Throughout the grant phases, the organization provided HTS to youths in a non-targeted approach. This means random set up of mobile testing tents in open spaces within community of coverage. It includes integrated service provision with collaborating organizations, that organizes outreaches in the community. In 2018-2019, they implemented a targeted approach of providing HTS amongst the females 15-24 years only.

The targeted approach, had in addition to the former activities, a purposeful testing work plan based on explored vulnerability factors. Factors such as social/sexual lifestyle, concurrent multiple partnership, risky location and occupation, predisposing the female youths to HIV. This factors were used to profile and mobilize youths for a voluntary HTS, alongside BCC for 18 months. The youths were actively involved in the hotspot mapping, mobilization and HTS implementation. Intervention states were Akwa-Ibom, Oyo & Abuja.

1.6 Research question

- Does targeted approach, when compared to non-targeted approach, increase HTS uptake and positivity yield, amongst youths in Nigeria?
- To what extent can changes at state level (HMIS) and at project level be attributed to the intervention?
- What were the particular features of the program and context that made a difference in the targeted approach?

1.7 Justification

The inability to detect all individuals with HIV has led to new approaches to increase known HIV cases and put them on treatment. (39) Targeted approach is ideal for delivering HTS to the high risk population. (44) Since there is limited evidence on the effectiveness of different strategies of targeted approaches in Nigeria (27), it is difficult to advocate for project scale up amongst the youths (34). The last national epidemiology evaluation and impact assessment was done in 2014 at the general population level. (45) The next survey is overdue, and the current national reports and literatures does not provide new evidence to improve HTS and address the rising new infection amongst youths (46,47).

The WHO, HTS guidelines notes that there is need of a tailor-made programme for HTS provision to youths. It supports evaluation of pilots interventions for effectiveness, especially when contextualized, targeted and implemented in a specific group. (27,48) Conducting an effect evaluation of non-targeted and targeted HTS approach amongst youth in Nigeria, will help to provide evidence. This can inform decision making and funding allocation by donors and government for optimum results. (6) The outcome of such an evaluation study can inform the new national strategic plan 2020 which is aiming towards UNAIDS vision 2030. (49)

This information gap can contribute to an increased HIV transmission in the general population, because the sexual network of the youths cut across the general and key polulations. (27) Also, youths are within the reproductive age and work force, they face the difficulties of living with HIV in the presence of stigma and discrimination which affect their access and utilization of service. (50) Fear of stigmatization by the population can be experienced by young people, who are a member of the key population and transgenders, when they have to access an unfriendly health facility. (27)

The consequences of not having adequate access to testing services for youths is diverse.(27) It could lead to a surge in HIV transmission due to a break in information delivery, during the pre & post counselling session on how to prevent infection during HTS.(51) Shortage in commodity distribution, such as free condoms and the demonstration of condom use during service uptake, will be lacking. (27,32) Those living with HIV, that are pregnant or mothers, often have low self-esteem, this can affect their children and reduce family cohesion. (32) Continued lack of targeted testing for high risk groups, including youths, have some societal consequences on their finances and quality of life. (17) Therefore, there is a critical need to evaluate HTS interventions to establish what works. This calls for documentation of effective concepts in a context driven approach amongst youths.

This was supported by Dellar et al 2015, who noted that future intervention should be rigorously assessed for effectiveness in controlled trials for biological outcomes. This infers for prioritizing a wide-scale implementation to maximise efficiency and effectiveness of resource allocation. (52) To assess this approaches, data generated by the organization (SFH) in an HTS project amongst youth will be assessed. I will analyse the data to find out which of the approaches are best at increasing the HTS uptake and generate more positivity yield.

1.8 Overall study objective

To evaluate the effectiveness of targeted approach on HTS uptake and positivity yield amongst youths in Nigeria, as compared to non-targeted approach and make recommendations for improved programme design by government and donor agencies.

1.8.1 Specific objectives

- To determine the trend of the HTS uptake and positivity yield in a non-targeted and targeted approach at the intervention states using the project data.
- To determine the trend of HTS uptake and positivity yield at the intervention states, using the HMIS data.
- To explore factors that explains the trend of HTS uptake and positivity yield.
- To use findings to make recommendations for effective designing of youth tailored HTS programming

CHAPTER 2- METHODOLOGY

2.1 Study location

There are 3 intervention states: Akwa Ibom, Oyo and Abuja in this study, and 3 comparism states: Rivers, Lagos, Nasarawa. The states were purposively paired based on similarity in geopolitical region, HIV prevalence (17), socio-economic and cultural practices as itemized in table 1. They have the presence of teaming youth population driving a lot of higher education institutions, cooperate companies and industries (6,8,53,54).

Table 1: Comparism of state demographics in Nigeria

State	**HIV prevalence (%)**(17)	**Geopolitical zones**	**Socio-economic Activity**	**Socio-cultural similarities**	**Presence of intervention (targeted HTS)**
Akwa-Ibom	5.6	south-south	High	Yes	Yes
Rivers	3.8	south-south	High	Yes	No
Oyo	0.9	south-west	Moderate	Yes	Yes
Lagos	1.3	south-west	High	Yes	No
Abuja	1.5	north-central	High	Yes	Yes
Nasarawa	1.9	north-central	Moderate	Yes	No

2.2 Study Design

A comparative assessment of longitudinal data from HTS routine activities. Using a mixed method, of quantitative (secondary dataset) and qualitative (key informant Interview and programme reports).The study designs will be explained in 2 sections by quantitative and qualitative approach.

2.3 Quantitative section

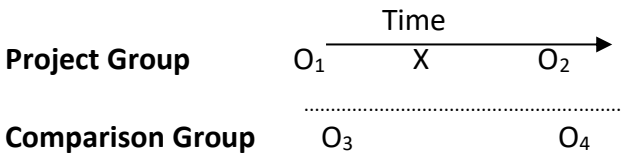
To answer the objective one and two, which determines the trend of HTS uptake and positivity yield in a targeted approach and non-targeted approach. And also check for the extent attribution of changes seen at state level (HMIS) and at project to the intervention.

2.3.1 Research method

This was a quasi-experimental study of before and after intervention in three intervention states. Before-intervention; non-targeted testing was done while during-intervention, targeted testing approach was implemented. The main comparison was between the three intervention states. A supplementary comparism was done between females and males of the same age group.

There were 2 levels of analysis; The project level using project data at the intervention states comparing before and after intervention. The state level using HMIS data at the intervention states, compared before and after intervention, in the presence of similar comparison states. The outcomes checked were number tested & number positive. Summary of both data sources are;

(A) HTS programme data from the SFH project, which was implemented amongst female youths 15-24 years in a non-targeted approach (2016-2017) and targeted approach (2018-2019). Data was also available for males in a non-targeted approach in both phases.
(B) Data sets from the HMIS platform, for both the intervention states and comparism states, for the period of 2016-2019. The project data was a subset of this HMIS data, which also includes all other data from implementation partners in the states. Data was available for both male and females 15-24 years.



The comparism group had the absence of similar intervention (targeted approach of HTS) being evaluated in the experimental group. A pre-intervention phase (O_1) was done using a non-targeted approach of HTS in the intervention states amongst male and females. Then at time X ; an intervention called targeted approach was introduced and then implemented throughout the post-intervention phase (O_2) amongst the females only in the same locations as O_1.
For the purposes of controlling, for external influence, the comparism states were included. They also had the pre-intervention phase(O_3) using non-targeted approach amongst males and females conducted at the same time as in the intervention states . This continued to post-intervention phase (O_4) still using a non-targeted approach amongst same male and females.

2.3.2 Ethical considerations

The Research proposal obtained a waiver for a secondary data analysis from the KIT research ethical committee. The datasets were anonymised from the host organization and Nigeria's Health information system (HMIS) website.

2.3.3.Sampling method and size

Being a retrospective evaluation, there was no sampling method or size calculated for this study. The secondary data was already collected from routine HTS outreaches at the community and facility from clients. The intervention covered more than two-third of communities in each states. In the remaining communities, other NGOs/government HTS activities offered HTS services which were reported in the HMIS data.

2.3.4 Data collection

The data were downloads from DHIS2 data manager. The project data was on monthly basis and disaggregated by age and sex. The state HMIS data was on a 6 monthly basis. The indicators of interest include; number tested=those that were counselled, tested for HIV and received their result. Number positive= of those tested, those HIV positive for the first time (new positive), positivity yield (%)= total positive/total tested *100.
Limitation: Due the secondary data, measurement bias cannot be entirely ruled out.

2.6 Data quality

The project dataset was downloaded from the DHIS2 platform and checked for quality by comparing it with the programmatic reports. The HMIS data was difficult to verify due to multiple primary sources. It was checked for consistency by eyeballing for outliers.

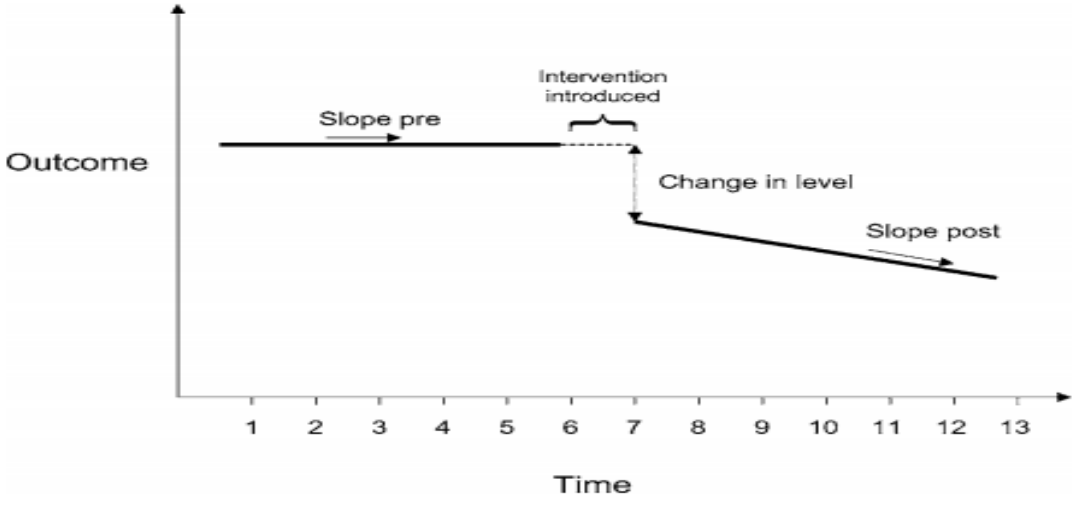
2.7 Statistical analysis

The statistical test applied, was Interrupted time series analysis, (ITSA) on Stata16 software. Using bi and multi-variate logistic regression, the coefficient was calculated at 95% confidence interval. (55) Trend analysis was used to explore the outcome; number tested and number positive) while comparing by state, age, sex and approaches to determine the effectiveness. (56) ITSA was adopted because it was the most appropriate method for analysing quasi-experimental studies. The strengths are in its ability to draw inferences in a study that is non-randomized. It is the most preferred method in literature, for studying trends over time, on aggregated data. (55–57)

The method also accounts for individual bias and changes, due to seasonal events likes mass campaigns, natural disasters etc. In addition to providing population level attribution, which is supported by correcting for intended and unintended bias, It is better suited than using randomized control trial. (55,58) With the study data set matching the strengths of ITSA, the figure 3 illustrates how a change in the slope can be used to answer objectives 1 and 2 of this study, which aims to determine the trend of HTS uptake and positivity yield at the project and HMIS level in the intervention states. The result was interpreted by attributing any change in direction of the slope-pre to the slope-post after an intervention was introduced. (59)

Also, a change in the slope level, was also an interesting finding, especially if the change was significant. This observed change in the outcome measures (number tested; number positive) can be positive or negative, depending on the effect of the intervention which is expressed in an upward direction of the slope or downward and checked by the regression for statistically significance. (57,59)

Figure 3: Schematic representation of Interrupted time series (ITS) method for measuring effect of an intervention.



Source: The Interrupted Time Series Designs in Health Technology Assessment, Ramsay et al 2003. (59)

In this study, the number of time points before and after intervention are as follows; At monthly program data; before (24), after (18) points. At six-monthly HMIS data level, before (4), after (3) points. Some literature suggests at least eight time points for the before and after should be available, to achieve a strong correlation. (60) However, Linden et, al 2010,

supports that, although fewer may be weak in attributing causality, including a control group, could help to correct for this weakness. (55) The variables and measurement, there were dependent variables; namely "number tested" and "number positive". The explanatory variables were four; states, age, sex and phase (pre-intervention or post-intervention) to elucidate the HTS uptake and positivity yield.
Like every other method, ITS has its limitations, which includes inability to make inferences at individual level, nor establish the exact causal time that an intervention caused a change seen. (57) ITSA was still the most appropriate method for a solid analysis of this study that was generalizable. (55)

2.4 Qualitative section

This is to explore the objective 3 which aims to explore factors that can explain the trends observed in the regression. Also, to get insight into the particular features of the program and context that made a difference.

2.4.1 Research method

Key informant Interviews (KII) were done with health professionals that implemented the project or were experienced in HIV response in the states. The interviews explored their professional experience on their job and reflection on the preliminary findings of the data analysis. The interview explored reasons for the trends, explaining disparity and possible confounders. Project narrative reports were also analysed to triangulate with the quantitative results.

2.4.2 Ethical considerations

The Research proposal obtained a waiver for a secondary data analysis and KII from the KIT research ethical committee. Informed consent for participants and the interview guide was developed for the study and rectified by the committee (copy in annex A&B). The study objective, confidentiality, benefit and participants rights, were read by the interviewer, was discussed with all participants, before commencement of the interview after consent, was given. The interview was conducted via Zoom Application, due to the covid-19 pandemic.

2.4.3 Sampling method and size

There was 6 KII, 2 per project state with health professionals ranging from managers, counsellor testers, directors and officers. Twenty list of staffs that participated in the project was shared by the organization and 10 shared by the state agency for the control of AIDS. Excel was used to randomly select six coded respondent. Two replacement was used

2.4.4 Data collection method

The secondary data was collected from progress reports of the project, from the implementing organization; SFH. Based on reports and literatures, a semi-structured interview guide was developed and pre-tested to facilitate the KIIs. ATLAS ti software was used to manage the interview transcripts, project report and literature for triangulation. The quotes from the respondent was coded deductively and organized by thematic areas. Reports were generated by themes and memo narratives used to harmonize the findings, in addition

with literatures within 2010 and 2020 year period were used to triangulate. However, very important evidences below the inclusion date was still considered.
Limitation: The respondents may be subjected to recall bias of the event that had taken place within the four years period of the project. They may or not allude some information to the project that may or may not apply.

2.6 Data quality

The key informant interviews were checked for verbatim transcription by 2 reviewers, before transferring to the data manager.

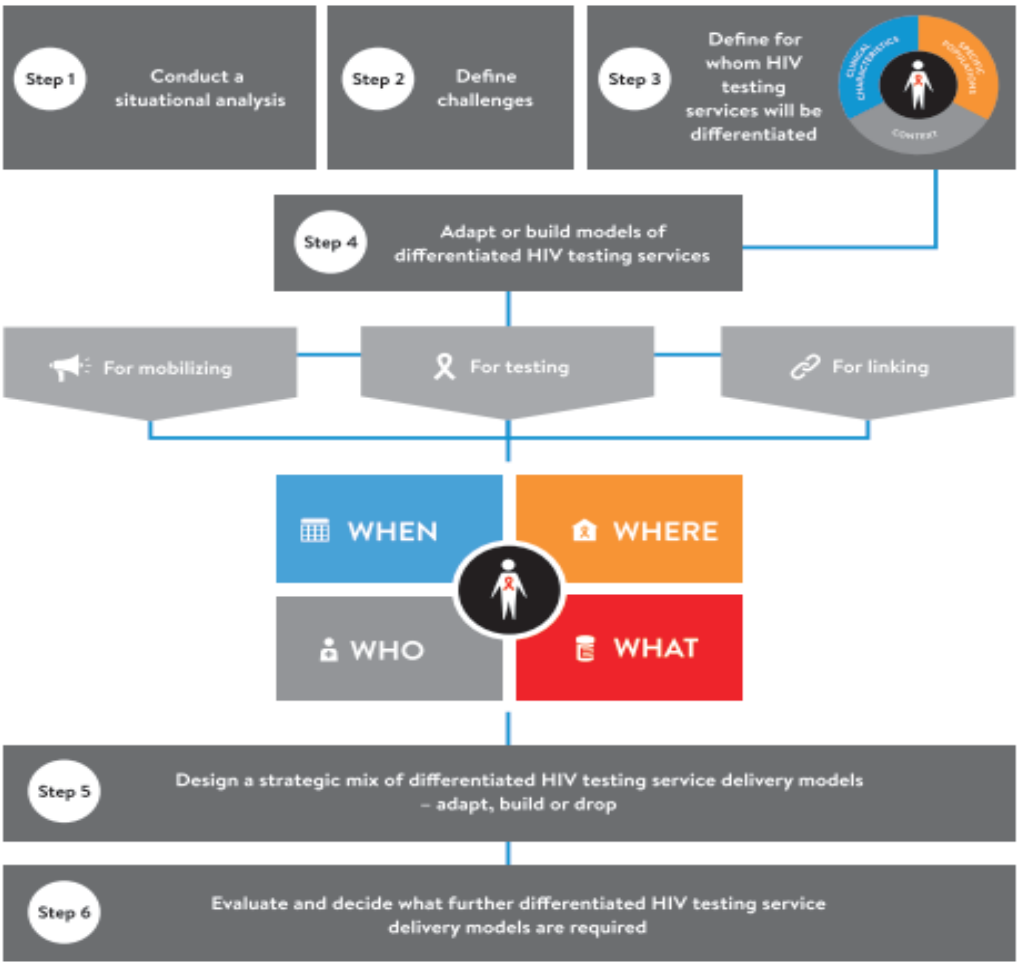
2.8 Analytical framework

To explore factors, that explain the trend seen in HTS uptake and positivity yield, a theory of change (TOC) for HTS intervention, processes and outcome was developed for this study analysis. The effect of the targeted testing, differs from place to place. (3,27) Some conceptual frameworks were considered for adoption but limited in the providing evaluation guide.
A proximate-determinant framework by Boerma et, al 2005, exploring factors affecting the risk of sexual transmission of HIV was considered. It has been applied extensively in the study of HIV, ART, fertility and child survival in developing countries. (61) This framework was very rich in providing the underlying and immediate factors, that influences people risk levels, but was limited in providing the structural and technical component required to provide HTS.

The Levesque et al, 2013 framework of access to health was also considered to explain these factors. The model looks at the opportunity to access health service from the perspective of clients and providers, towards utilization of service. (62) This is a solid and improved framework capturing the 5As[2] built on previous conceptualizations from Bashshur et al., 1971, Donabedian, 1973, Salkever, 1976, Aday & Andersen, 1974, Penchansky & Thomas, 1981, Dutton, 1986, Frenk, 1992, Margolis et al., 1995, Haddad & Mohindra, 2002, Shengelia et al., 2003, and Peters et al. 2008. (62) But the framework was too generalized that it did not appropriately captured the needs, in evaluating the HTS activities, especially the targeted approach.
Moving forward, both frameworks informed different components of the developed study's TOC, which was based on the IAS & WHO 2018 HTS guideline framework in figure 4. (3)

[2] 5As- Accessibility, Accommodation/Approachability, Affordability, Availability and Appropriateness

Figure 4: Six steps Approach Framework to differentiated HIV Testing Services

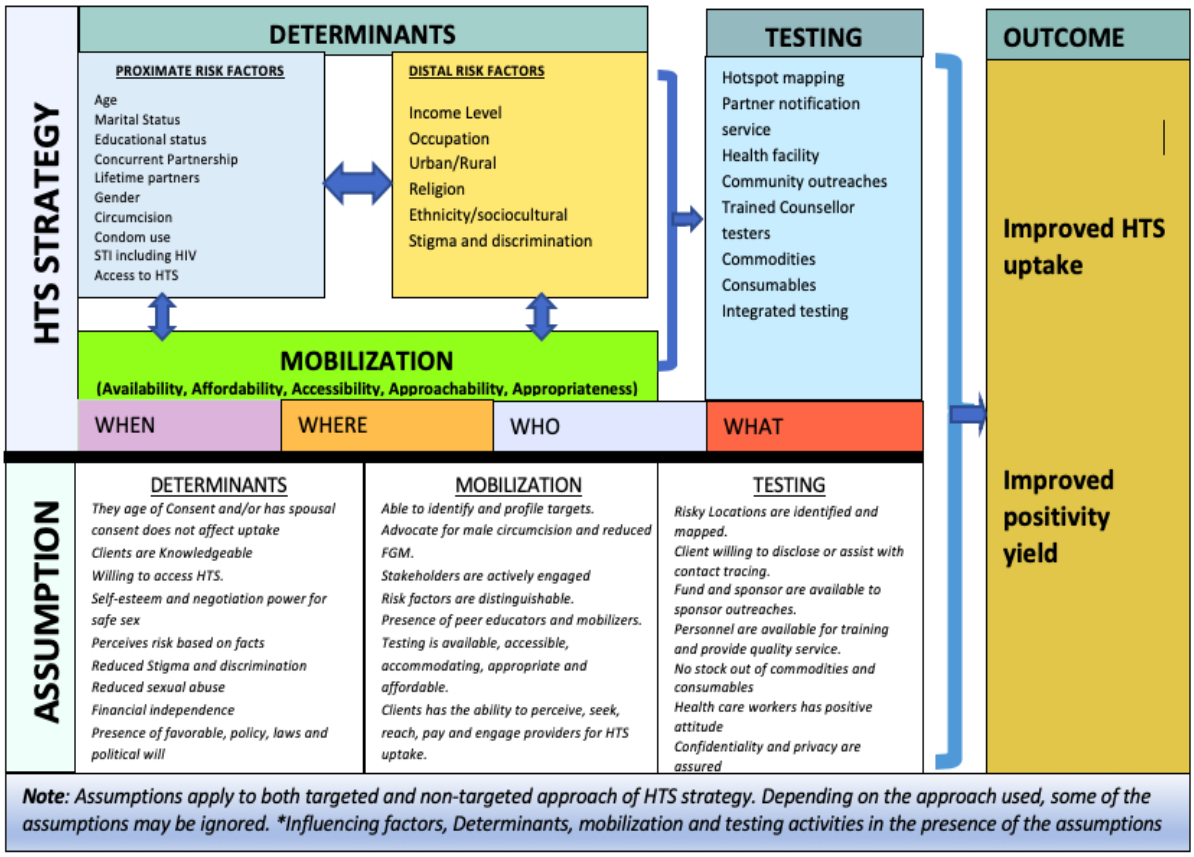


Source, AIS &WHO, differentiated HTS care model; 2018 (3)

This framework informed the TOC based on the Nigerian context, as guided by literature and the protocol of the project being evaluated. Figure 4 was at the centre of the TOC developed (44). Levesque et al, 2013 & Boerma et,al 2005 itemized the determinants (distal and the proximate factors) such as age, sex, sociocultural practices, sexual network, place of residence and socio-economic status, occupation etc. (61,62)

Levesque et al, 2013 and AIS &WHO, 2018 informed the mobilization and testing component of the TOC (3,62). The underlying assumptions were based on the three frameworks, project protocol and other literatures findings (3,61–63) The evidence suggest that social, economic, structural, and environmental factors must be accounted for, to explore the underlying factors that influence risk level and uptake of HTS. The articles were consistent with the project protocol (64) and supported by literatures. (32,50,65–68)

Figure 5: A theory of change for HIV Testing Service (HTS) strategy.



Developed for the Thesis.

Resources; IAS &WHO framework for differentiated HTS delivery, 2018; Levesque et al. 2013 frame work for patient centred access to health care, 2013 & Boerma et al, 2005 Proximate determinant framework. (3,61,62)

Figure 5, was the consolidated TOC for HTS strategy which was flexible to evaluating non-targeted or targeted approaches, putting into consideration, community and facility based testing delivery centers. (3) From the left side of the TOC, the determinants can effectively influence mobilization, provided the assumptions are met; the outcomes (improved testing positivity yield) will be achieved. For each of the proximate and distal factors, they can be mutually inclusive or exclusive. In other words, there are possibilities that proximate and distal factors may co-exist or may not. For testing to be effective and achieve the outcomes; all the layers have to work together.

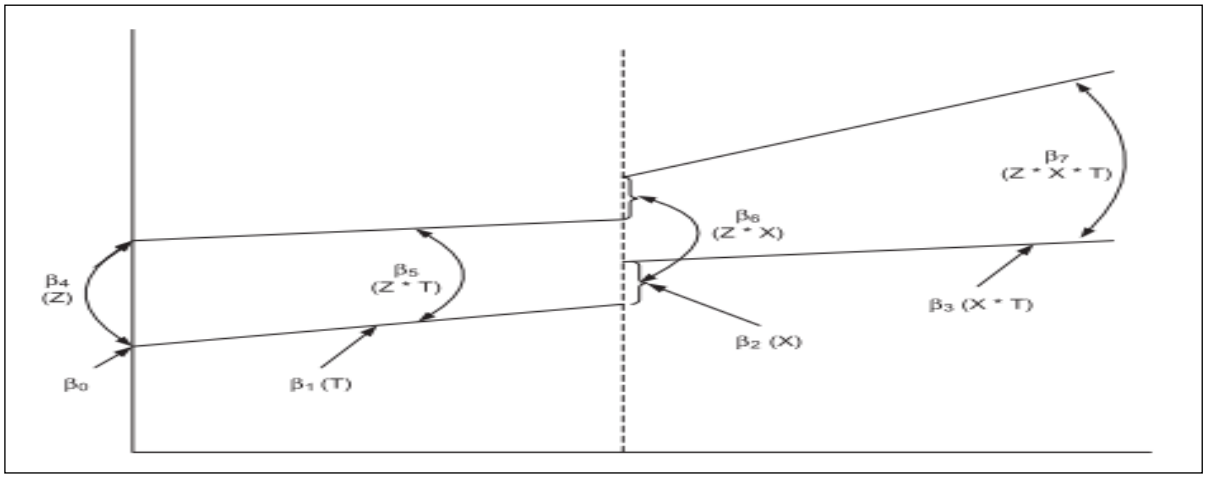
The distal and proximate risk factors, determine the quality of mobilization. While mobilization operations requires the 5 As for access (62); and 4Ws principles of knowing 'when' they can be reached, 'where' they can be found, 'who' they are and associate with; and 'what' they prefer in accessing service to achieve the testing plan. (3) All these components depend on if the assumptions, which are generally human perceptions, structural, human resources, finance management and development plans or opportunities being in place to enable successful implementation of HTS and achieve the outcomes of improved HTS uptake and Positivity yield.(69)

CHAPTER 3- RESULT

3.1 QUANTITATIVE RESULT

This are the results for the trend of HTS uptake and positivity yield in a non-targeted and targeted approach at the intervention states. Interrupted time series analysis (ITSA) commands was done in Stata16 software on a bi and multi variate regression (figure 6). The regression was done at 2 stages; using the project and HMIS data separately.

Figure 6: Visual representation of ITSA for bi and multivariate regression



Source: Conducting ITSA for single- and multiple-group comparisons. Linden et al, 2015. (56)

In figure 6, the single group (lower line) and multiple group (upper and lower) were applied in this study. The following regression model formula was applied when there was only one group under study.

Equation 1

$$y_t = \beta_0 + \beta_1 T + \beta_2 x_t + \beta_3 T x_t$$

y_t = aggregated outcome variable measured at each equally spaced time point t,
T = time since the start of the study,
x_t =dummy (indicator) variable representing the intervention (pre-intervention periods 0, otherwise 1), and Tx_t is an interaction term.

When there were multiple groups, including comparison groups, the regression model in (Equation 1) was expanded to include 4 additional terms (Beta_4 to Beta_7), this is represented below;

Equation 2

$$y_t = \beta_0 + \beta_1 T + \beta_2 x_t + \beta_3 T x_t + \beta_4 Z + \beta_5 ZT + \beta_6 Z x_t + \beta_7 ZT x_t$$

In addition to the above details above for eqn. 1,
Z is a dummy variable to represent the group assignment (experimental or control),
ZT, Zx_t, and ZTx_t are all interaction terms among previously described variables in equation 1
Beta_0 to Beta_3 are the coefficients representing the control group
Beta_4 to Beta_7 the coefficients represent values of the experimental group.
Beta_4 represents the difference in the level (intercept) of the dependent variable between experimental and controls before the intervention

Beta_5 represents the difference in the slope (trend) of the dependent variable between experimental and controls before the intervention,
Beta_6 indicates the difference between experimental and control groups in the level (intercept) of the dependent variable, immediately following introduction of the intervention,
Beta_7 represents the difference between experimental and control groups in the slope (trend) of the dependent variable, after initiation of the intervention, compared with preintervention (this is similar to a difference-in-differences of slopes).(56)(55)

3.2 Descriptive findings

3.2.1 Project data level

The total number of 15 to 24 years, tested in the project, across three intervention states was 190,484. Of this, 3,038 were positive; i.e. the positivity yield was 1.6% for the period of 2016-2019 (table 2).

Table 2: Disaggregation of HTS uptake and the positivity yield at project level in intervention states

Periods	Indicator	Akwa-Ibom			Abuja			Oyo		
		Male	**Female**	**Total**	**Male**	**female**	**Total**	**Male**	**female**	**Total**
Jan 2016-Dec 2017 (non-targeted)	Number tested	19,197	22,325	41,522	12,101	11,190	23,291	11,003	15,797	26,800
	Number positive	79 (0.4%)	231 (1.0%)	**310 (0.7%)**	23 (0.2%)	106 (0.9%)	**129 (0.6%)**	12 (0.1%)	44 (0.3%)	**56 (0.2%)**
Jan 2018-Jun 2019 (targeted)	Number tested	12,998	53,762	66,760	1,478	11,307	12,785	5,580	13,746	19,326
	Number positive	105 (0.8%)	1,744 (3.2%)	**1,849 (2.8%)**	12 (0.8%)	354 (3.1%)	**366 (2.9%)**	29 (0.5%)	299 (2.2%)	**328 (1.7%)**
Jan 2016-Jun 2019 (Overall)	Total tested	32,195	76,087	**108,282**	13,579	22,497	**36,076**	16,583	29,543	**46,126**
	Total positive	184 (0.6%)	1,975 (2.6%)	2159 (2.0%)	35 (0.3)	460 (2.0%)	495 (1.4%)	41(0.2%)	343 (1.2%)	384 (0.8%)

In table 2, during targeted approach of HTS, the positivity yield was remarkable for Abuja at 2.9% and 2.8% for Akwa-Ibom when compared to their number tested respectively. In non-targeted approach, all the states had a less than 1% positivity yield.

3.2.2 HMIS level Data

In this section, the project level data were inclusive of the HMIS data that represents the whole state. The total number tested across the three intervention states was 2,832,991; of which 36,491 were positive with a positivity yield of 1.6% for the period of 2016-2019. (table 3).

Table 3: Disaggregation of HTS uptake and the positivity yield at HMIS level in intervention states

Periods	Indicator	Akwa-Ibom			Abuja			Oyo		
		Male	Female	Total	Male	Female	Total	Male	Female	Total
Jan 2016-Dec 2017 (non-targeted)	Number tested	271,776	338,737	610,513	309,579	371,815	681,394	363,904	308,531	672,435
	Number positive	3,602 (1.32%)	11,629 (3.4%)	15,231 (2.5%)	1,364 (0.4%)	4,285 (1.2%)	5,649 (0.8%)	694 (0.2%)	1619 (0.5%)	2,313 (0.3%)
Jan 2018-Dec 2019 (targeted)	Number tested	87,176	136,599	223,775	64,215	162,066	226,281	156,641	261,952	418,593
	Number positive	1,256 (1.4%)	7,645 (5.6%)	**8,901 (4.0%)**	533 (0.8%)	2,273 (1.4%)	**2,806 (1.2%)**	428 (0.3%)	1,163 (0.4%)	**1,591 (0.4%)**
Jan 2016-Dec 2019 (Overall)	Total tested	358,952	475,336	**834,288**	373,794	533,881	**907,675**	520,545	570,483	**1,091,028**
	Total positive	4,858 (1.4%)	19,274 (4.1%)	24,132 (2.9%)	1,897 (0.5%)	6,558 (1.2%)	8,455 (0.9%)	1,122 (0.2%)	2,782 (0.5%)	3,904 (0.4%)

The HMIS data distribution was different to the project level, as Akwa-Ibom had a three times more positivity yield than Abuja and 10 times more than Oyo during the targeted approach (table 3). In general, testing was highest in Oyo with almost two times more than Abuja and Akwa-Ibom.

Table 4: Disaggregation of HTS uptake and the HIV positivity yield at HMIS level in the Comparison states

Periods	Indicator	Rivers			Nasarawa			Lagos		
		Male	Female	Total	Male	Female	Total	Male	Female	Total
Jan 2016-Dec 2017 (non-targeted)	Number tested	64,256	157,552	221,808	66,012	112,847	178,859	182,840	283,167	466,007
	Number positive	1,107 (1.7%)	2,577 (1.6%)	3,684 (1.7%)	942 (1.4%)	2,980 (2.6%)	3,922 (2.2%)	1,280 (0.7%)	2,288 (0.8%)	3,568 (0.7%)
Jan 2018-Jun 2019 (targeted)	Number tested	51,694	120,538	172,232	61,982	145,944	207,926	172,150	263,090	435,240
	Number positive	636 (1.2%)	2,585 (2.1%)	3,221 (1.9%)	643 (1.0%)	1,675 (1.1%)	2,318 (1.1%)	1,856 (1.1%)	2,349 (0.9%)	4,205 (1.0%)
Jan 2016-Jun 2019 (Overall)	Total tested	115,950	278,090	394,040	137,816	148,924	286,740	354,990	546,257	901,247
	Total positive	1,743 (1.5%)	5,162 (1.9%)	6,905 (1.8%)	1,585 (1.2%)	4,655 (3.1%)	6,240 (2.1%)	3,136 (0.9%)	4,637 (0.8%)	7,773 (0.9%)

A total of 1,582,027 was tested in the three comparison states, of which 20,918 were HIV positive. In table 4, the number tested was similar to the intervention states. In the control, the testing and positivity yield was steady across the year and from the pre-intervention to the post-intervention phase.

3.3 Project data as a percentage of HMIS data

Table 5: Percentage contribution of project data to the HMIS data at intervention states.

Periods	Indicator	Akwa-Ibom			Abuja			Oyo		
		%Male	%female	%Total	%Male	%female	%Total	%Male	%female	%Total
Jan 2016-Dec 2017 (non-targeted)	Number tested	7.1	6.6	**6.8**	3.9	3.0	**3.4**	3.0	5.1	**4.0**
	Number positive	2.2	6.4	5.6	0.6	2.9	3.6	0.3	1.2	1.1
Jan 2018-Jun 2019 (targeted)	Number tested	**14.9**	**39.4**	**29.8**	2.3	7.0	**5.7**	3.6	5.2	**4.6**
	Number positive	8.4	**22.8**	**20.8**	2.3	**15.6**	**13.0**	6.8	**25.7**	**20.6**
Jan 2016-Jun 2019 (Overall)	Total tested	9.0	16.0	13.0	3.6	4.2	4.0	3.2	5.2	4.2
	Total positive	3.8	10.2	8.9	1.8	7.0	5.9	3.7	12.3	9.8

In table 5, the project contribution to testing during the non-targeted approach was below 10% across the intervention states. During targeted approach, contribution increased to 30% in Akwa-Ibom but Oyo and Abuja were still less than 10% in contribution to the HMIS data. During the targeted approach, the contribution to HIV positive cases was, 21% in Akwa-Ibom, 13% in Abuja and 20% in Oyo.

3.4 Regression of HTS uptake and HIV Positive cases at the Project level by states.

The time periods were monthly. The data for males started in January 2018 while the females started in April, due to delay in entry phase activities. Since the intervention; targeted approach of providing HTS was implemented amongst the females, April 2018 was set as intervention introduction time for the regression.
The results were interpreted by attributing any change in direction of the slope as increase or decrease, and the magnitude of the intercept shift by the slope as statistically significant or not. This change in the direction of the slope represents big, medium and small effect.
There were 24 before, and 18 after intervention time points. This was sufficiently powered for the analysis. There were 699 post-intervention linear trends in this regression.
The following trend results hereby presented illustrate HTS uptake, positive number, state, age, sex and phase of intervention. The vertical line across the charts represent introduction of the intervention.

Akwa-Ibom

Figure 7: Monthly Project Trend analysis for HTS uptake amongst youths in Akwa-Ibom, 2016-2019

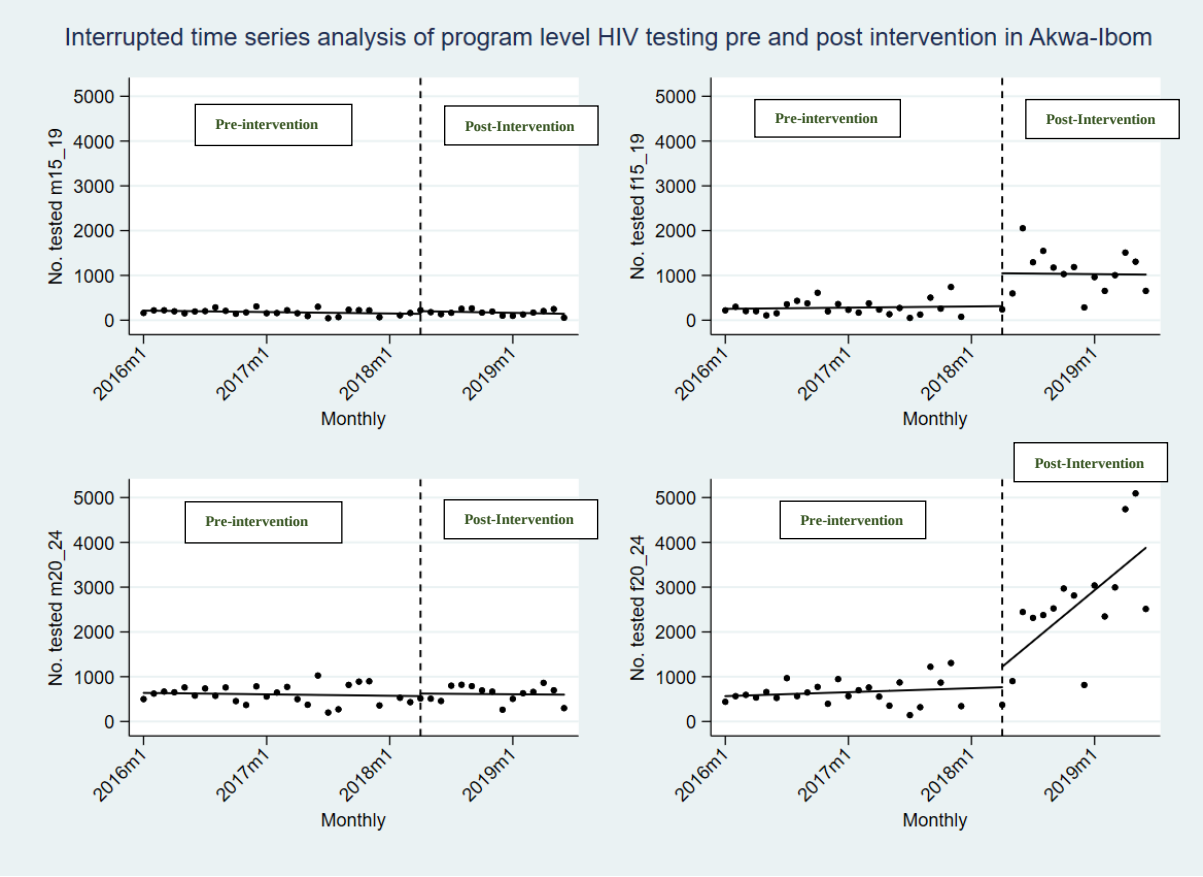
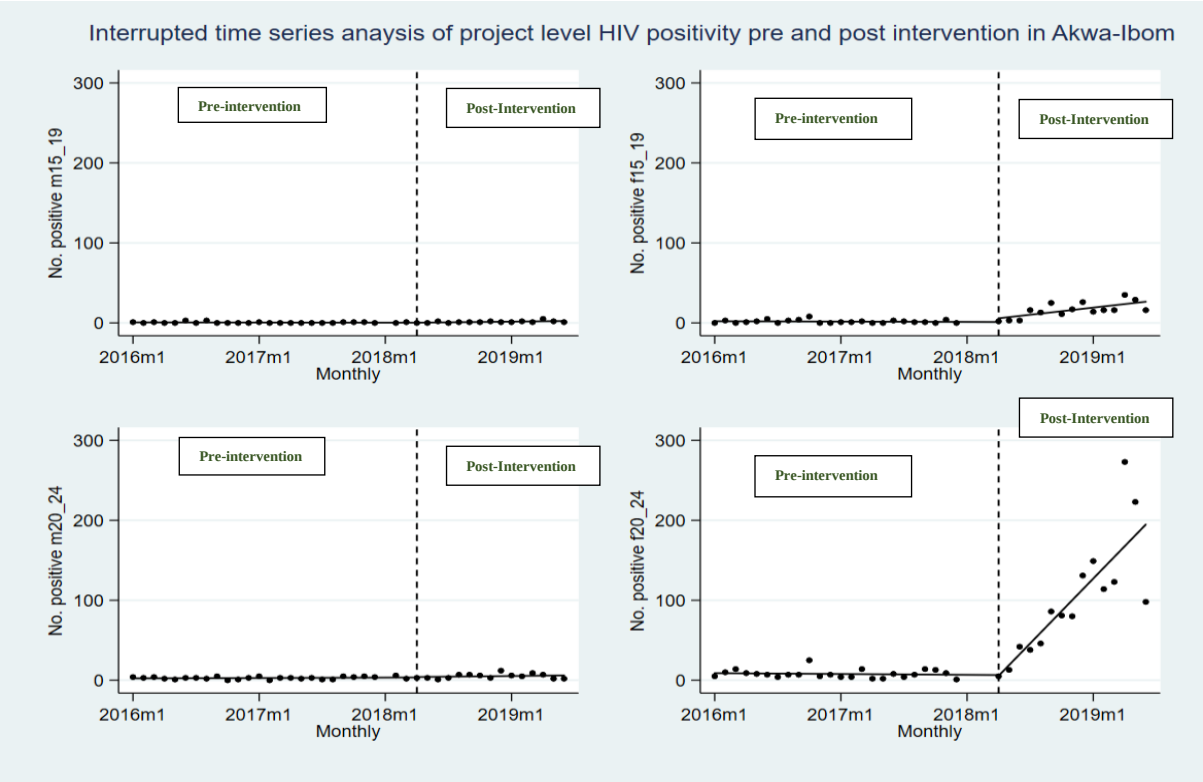


Figure 8: Monthly Project Trend analysis for HIV positive cases amongst youths in Akwa-Ibom, 2016-2019



In Akwa-Ibom, the average monthly testing pre-intervention was 181 for males 15-19 years old, this slightly decreased to 173 after the intervention. A slight increase was observed for males 20-24 years old, from 605 pre-intervention to 612 post-intervention.
Among females, the monthly average of testing increased considerable from 279 to 1033, among females 15-19 years post-intervention, and from 651 to 2551 for females 20-24 years.[3]

According to the ITS model[4], (Figure 7) in females 15-19 years, there was a decrease in testing (B:-2.1, CI:-72.8-68.6 p<0.95) not statically significant, but there was an increase in positive trend (B:1.48, CI: 0.5 –2.37 p<0.001) post-intervention and statistically significant (figure 8).

Amongst females 20-24 years, there was a considerable increase in the numbers tested post-intervention (B: 189, CI:61.4–318.0 P<0.004) statistically significant (Figure 7). In addition, a steeper positive trend was observed (B:13.5, CI:6.5-20.4<0.0004) statistically significant (Figure 8). There was no substantial gain in the testing and positive trend of the males and was not statistically significant.[5][6]

3 Average monthly data for HIV positive in Annex F
4 B: Coefficient
5 CI: Confidence interval
6 Linear trend Regression for males in Annex D

Abuja

Figure 9: Monthly Project Trend analysis for HTS uptake amongst youths in Abuja, 2016-2019

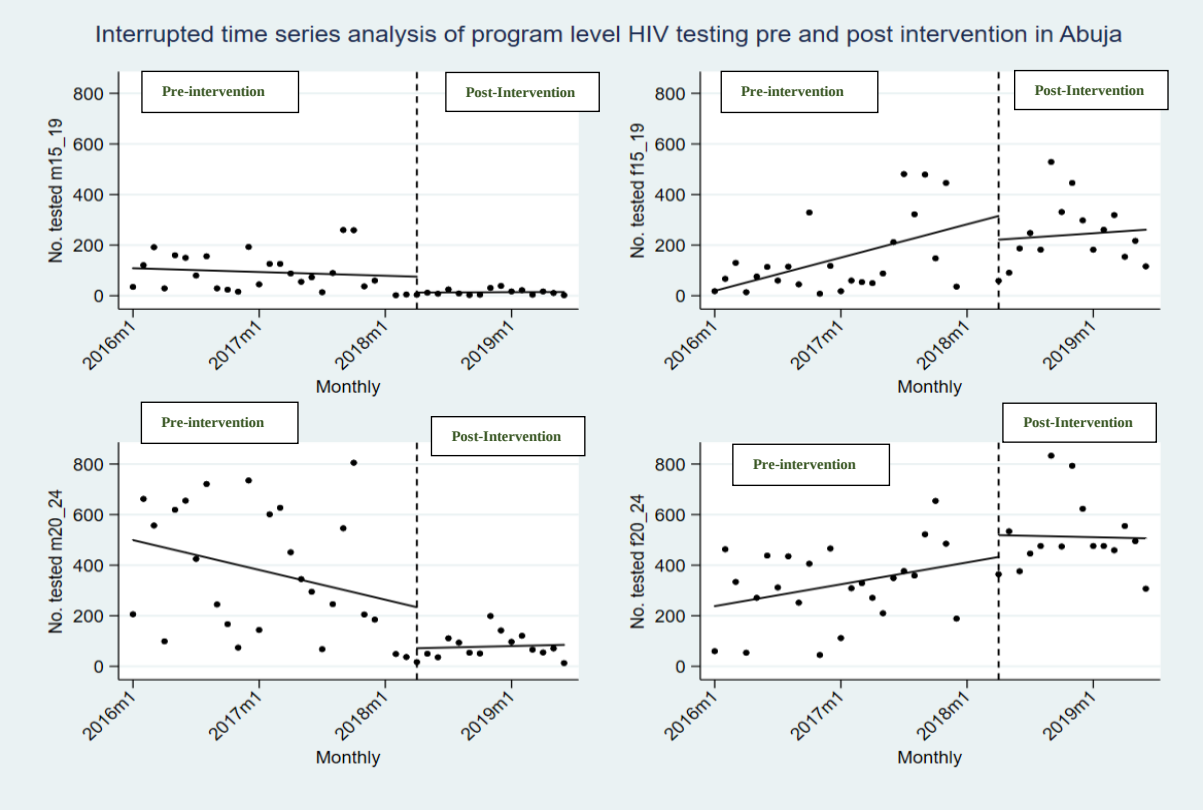
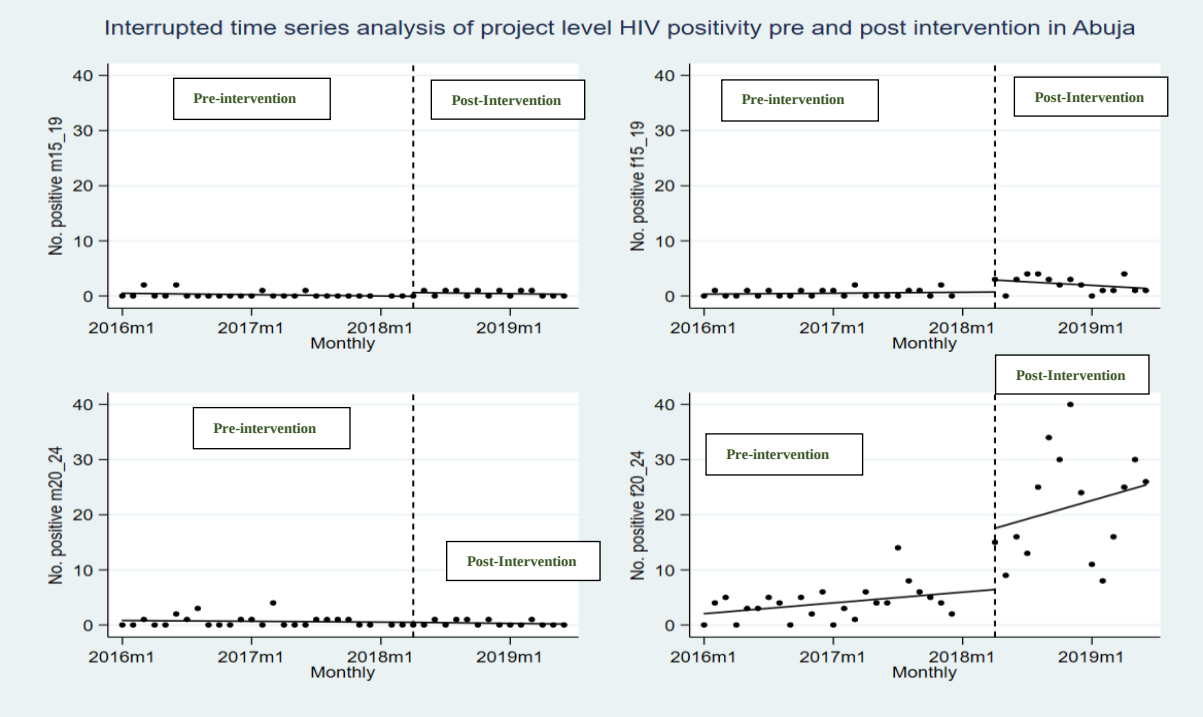


Figure 10: Monthly Project Trend analysis for HIV positive cases amongst youths in Abuja, 2016-2019



In Abuja, the average monthly testing pre-intervention was 93 for males 15-19 years old, this drastically decreased to 14 post-intervention. The same drop was observed for males 20-24 years, from 376 pre-intervention to 78 post-intervention.
Among females, the monthly average of testing increased slightly from 145 to 241 among 15-19 years and from 431 to 512 for 20-24 years. [7]

According to the ITS model, amongst females 15-19 years, there was an increase in the numbers tested post-intervention (B: 2.8, CI:-12.11-17.71 p<0.70), although not statistically significant (Figure 9). In addition, a slight decrease in positive trend was observed post-intervention (B:-0.10, CI:-0.28-0.06 p<0.22), also not statistically significant (Figure 10).

Amongst females 20-24 years, there was a slight decrease in the numbers tested post-intervention (B:-0.89 CI-16.67-14.88 p<0.908), and not statistically significant (Figure 9). A slight increase in positive trend was observed post-intervention (B:0.56, CI:-0.19-1.31 p<0.140) but not statistically significant. (figure 10)There was no substantial gain in the testing and positive trend of the males, and not statistically significant[8][9]

7 Average monthly data for HIV positive in Annex F

8 CI: confidence interval

9 Linear trend Regression for males in Annex D

Oyo

Figure 11: Monthly Trend analysis for HTS uptake amongst youths in Oyo, 2016-2019

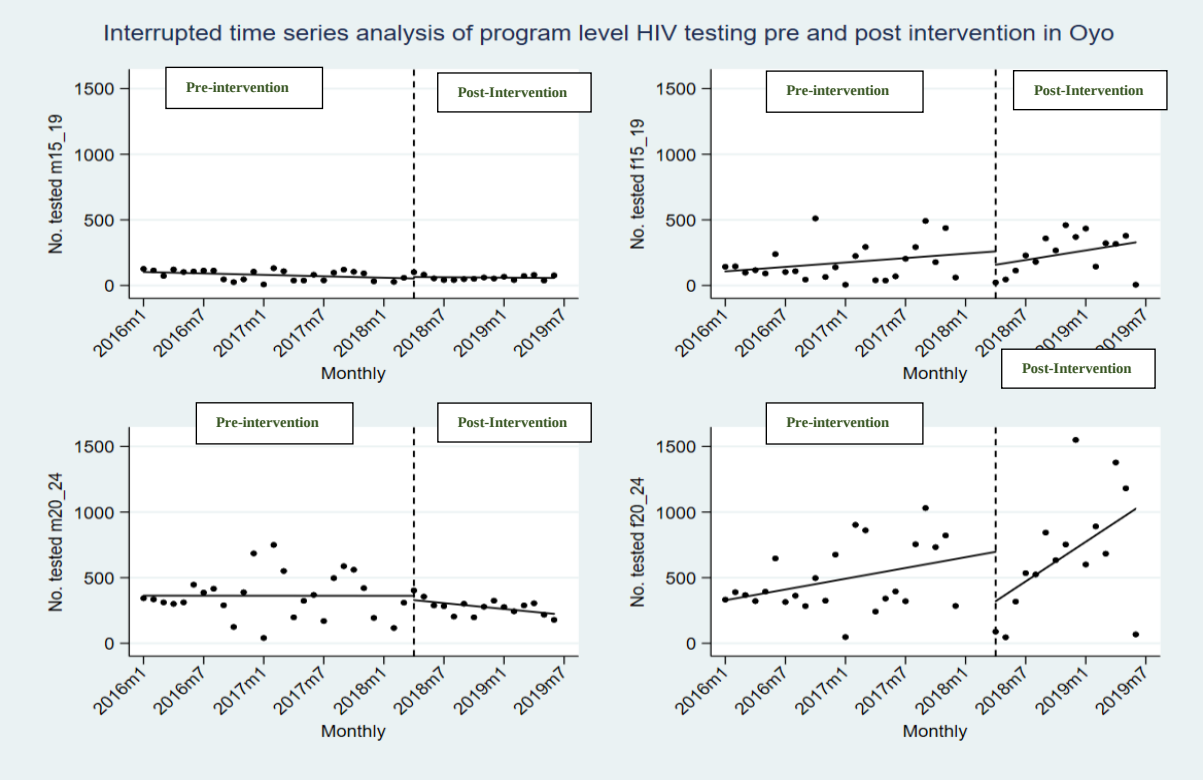
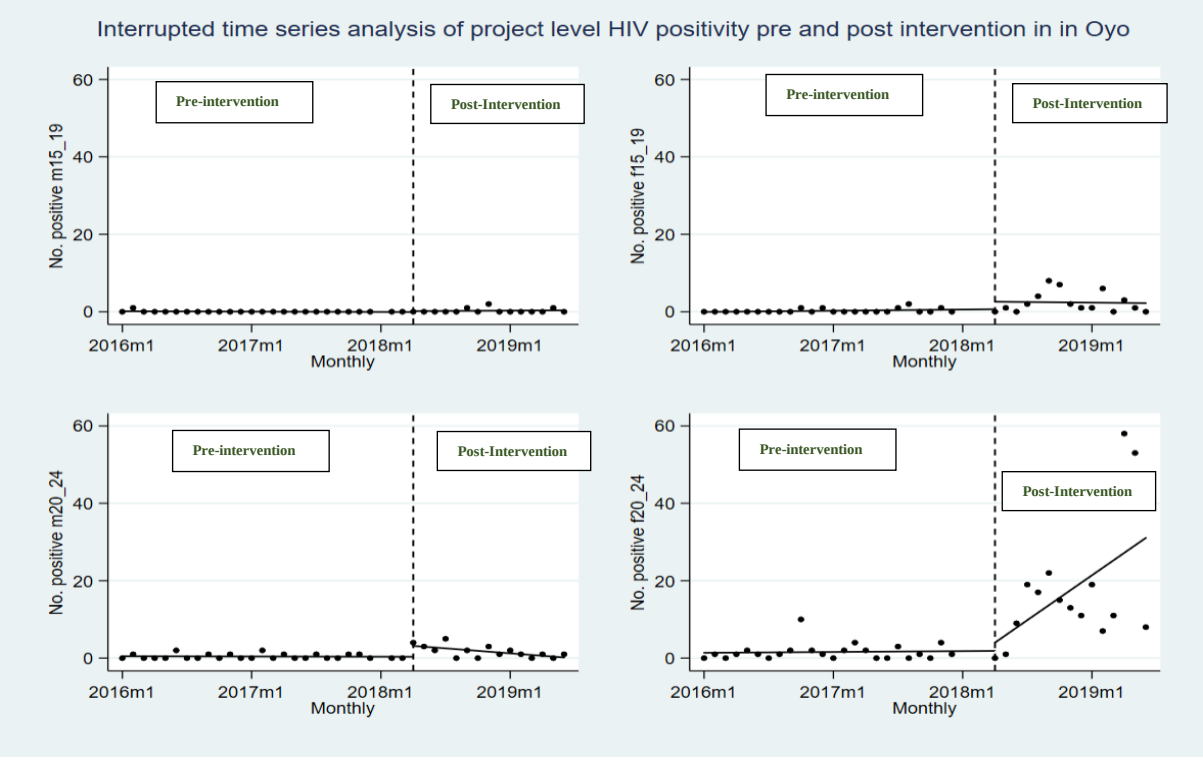


Figure 12: Monthly Project Trend analysis for HIV positive cases amongst youths in Oyo, 2016-2019



In Oyo state, the average monthly testing pre-intervention was 80 for males 15-19 years old, this slightly decreased to 61 after the intervention. Males 20-24 years old also dropped from 363 pre-intervention to 277 post-intervention.
Among females, monthly average of testing increased considerable from 173 to 243 among 15 to 19 years, and from 485 to 673 for 20-24 years.[10]

According to the ITS model, amongst females 15-19 years there was an increase in the numbers tested post-intervention (B: 12.18, CI:-8.38-32.74 p<0.23), although not statistically significant. (Figure 11) A similar positive trend was observed post-intervention (B:-0.002, CI:-0.29-0.24 p<0.85).(figure 12)
Amongst females 20-24 years there was an increase in the numbers tested post-intervention (B: 0.05, CI:-3.45- 2.39), although not statistically significant.(figure 11) In addition, a similar positive trend was observed post intervention (B:0.01, CI: -0.03-0.05 p<0.52). (figure 12) There was no substantial gain in the testing and positive trend of the males, and was not statistically significant[11][12]

[10] Average monthly data for HIV positive in Annex F

[11] CI: Confidence interval

[12] Linear trend Regression for males in Annex D

3.5 Regression of HTS uptake and HIV Positive cases at the HMIS level by state.

In this level of regression, there were two slopes representing the intervention and control states. The time period was bi-annual, because the HMIS data were only available in this format. The outcome was measured on a before and after intervention and also comparing male and females.

The intervention intercept was set as first six-month of 2018 because the project's targeted approach started in the period. There were 4 (pre) and 3 (post) intervention time points. This may not be powered enough to see true effect of the intervention, so results were read with caution. There were 116 post intervention linear trend.

The vertical line across the charts represent introduction of the intervention at the project level. The project data is a subset of the HMIS data.

Akwa-Ibom

Figure 13: Six-Monthly HMIS Trend analysis for HTS uptake amongst youths in Akwa-Ibom& Rivers, 2016-2019

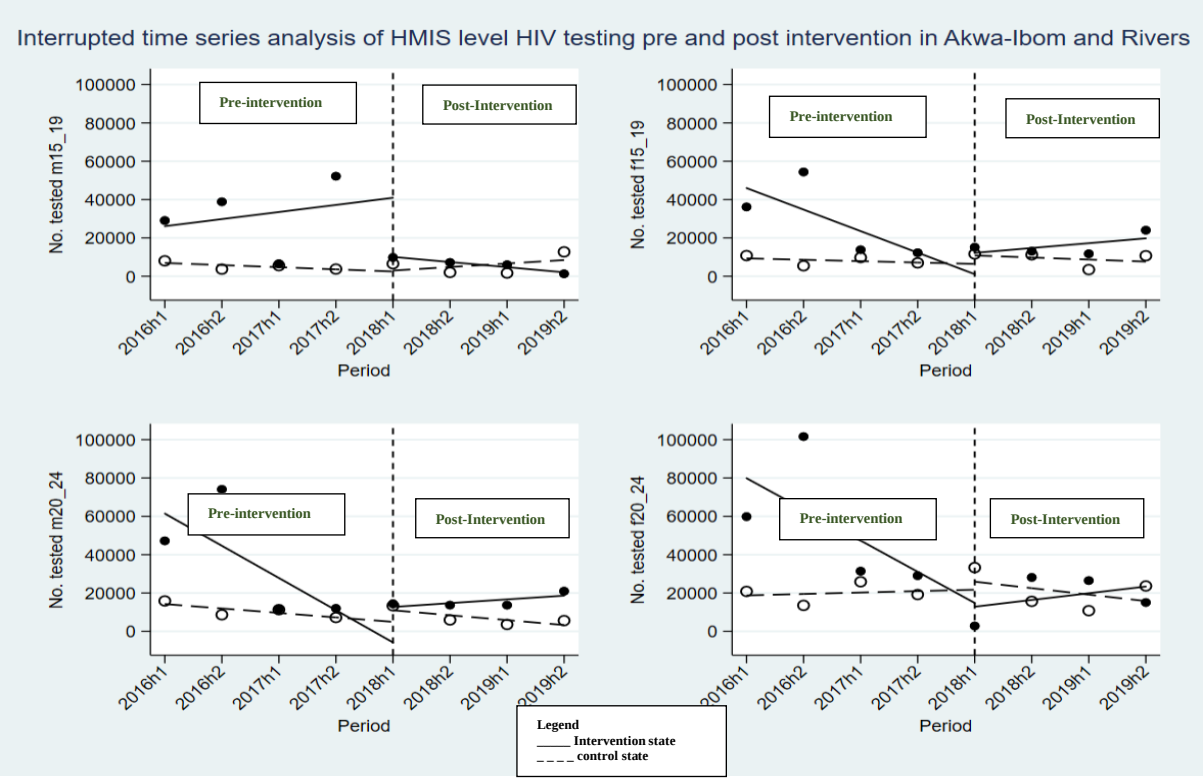
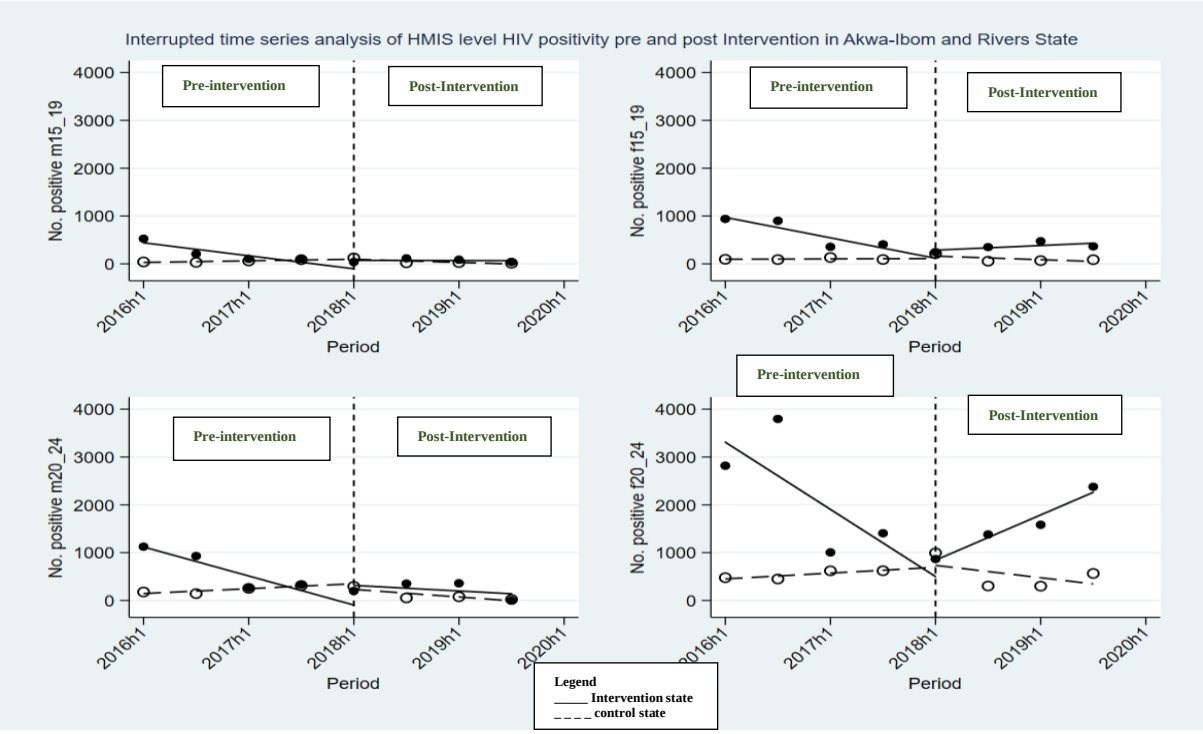


Figure 14: Six-Monthly HMIS Trend analysis for HIV positive cases amongst youths in Akwa-Ibom& Rivers, 2016-2019



In the single linear trend[13] for Akwa Ibom, [14] females 15-19 years had a considerable increase in the numbers tested post-intervention (B:16.3, CI:-0.03-32.8 p<0.05), although not statistically significant.(fig 13) In addition, an increased positive trend was observed post-intervention (B:11.6, CI:-6.55-29.84 p<0.13), however this change was also not statistically significant. (fig 14)

Amongst females 20-24years there was a considerable decrease in the numbers tested post-intervention (B:-26.2, CI:-89.7-37.2 p<0.27), not statistically significant.(fig 13) In addition, a tremendous increase in positive number trend was observed post intervention (B:27.4, CI: 26.4-28.5 p<0.00) and statistically significant. (fig 14)

However, at the multiple regression [15], accounting for the control state, a statistically significant increase was seen for the positives number amongst females 20-24 years, B:473.1, CI: 338.19-608, P<0.000, the difference in comparism to control state, was B: 602.2 and but not statically significant.

[13] Annex E1
[14] Average testing and HIV positive results are in Annex F
[15] Annex E2

Abuja

Figure 15: Six-Monthly HMIS Trend analysis for HIV positive cases amongst youths in Abuja & Nasarawa, 2016-2019

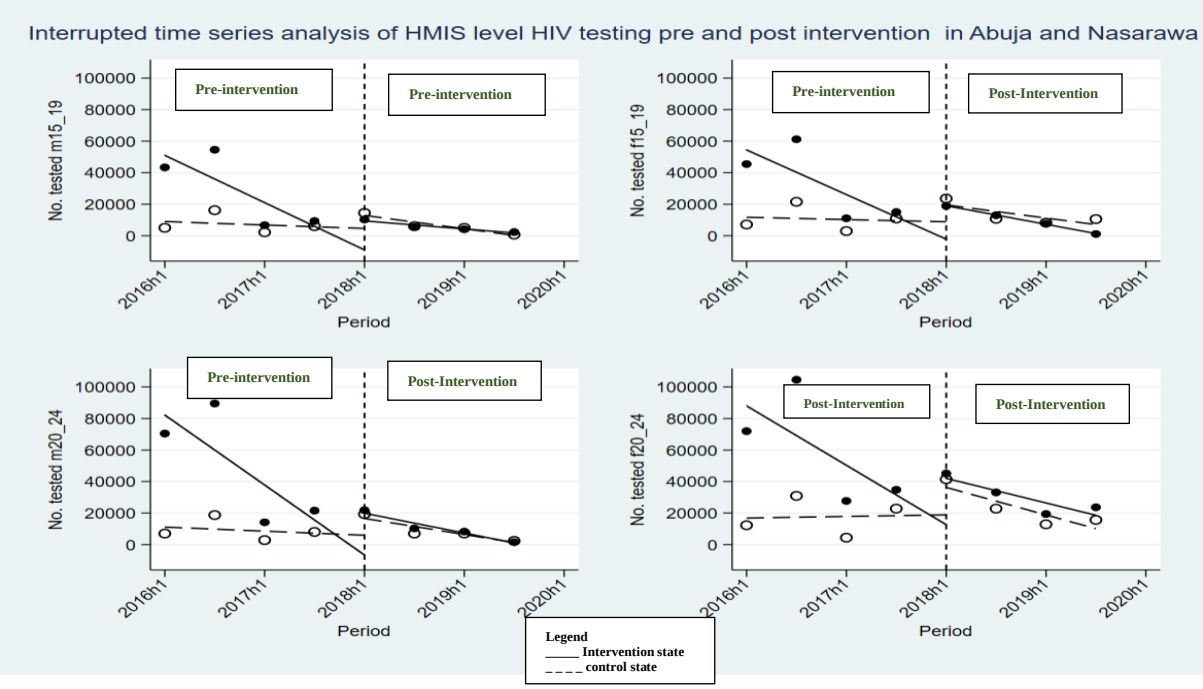
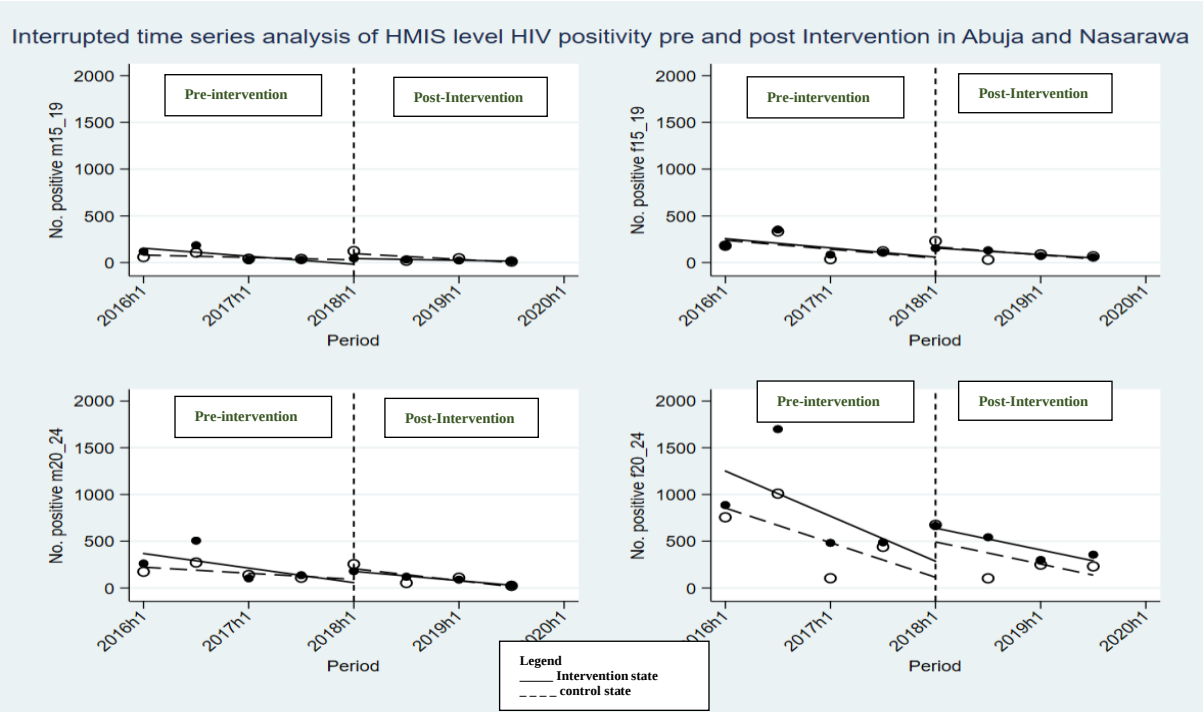


Figure 16: Six-Monthly HMIS Trend analysis for HIV positive cases amongst youths in Abuja & Nasarawa, 2016-2019



In Abuja, singe linear regression among females 15-19 years had a considerable increase in the numbers tested post-intervention (B:7.19, CI:-0.43-14.83 p<0.05), although not statistically significant.(fig15) In addition, an increased positive number trend was observed post-intervention (B:3.68, CI:-3.37-10.74 p<0.195) not statistically significant. (fig 16)
Amongst females 20-24years there was a considerable increase in the numbers tested post intervention (B:5.72,CI:2.90-8.54 p<0.00), and statistically significant.(fig15) In addition, a tremendous increase in positive number trend was observed post intervention (B:16.38, CI:7.03-25.7 p<0.01), and statistically significant.(fig16)
The Test of multiple linear trend shows that the difference between intervention and control state average was not statistically significant for HIV testing and positive number after accounting for pre and post intervention period.

Oyo

Figure 17: Six-Monthly HMIS Trend analysis for HTS uptake amongst youths in Oyo & Lagos, 2016-2019

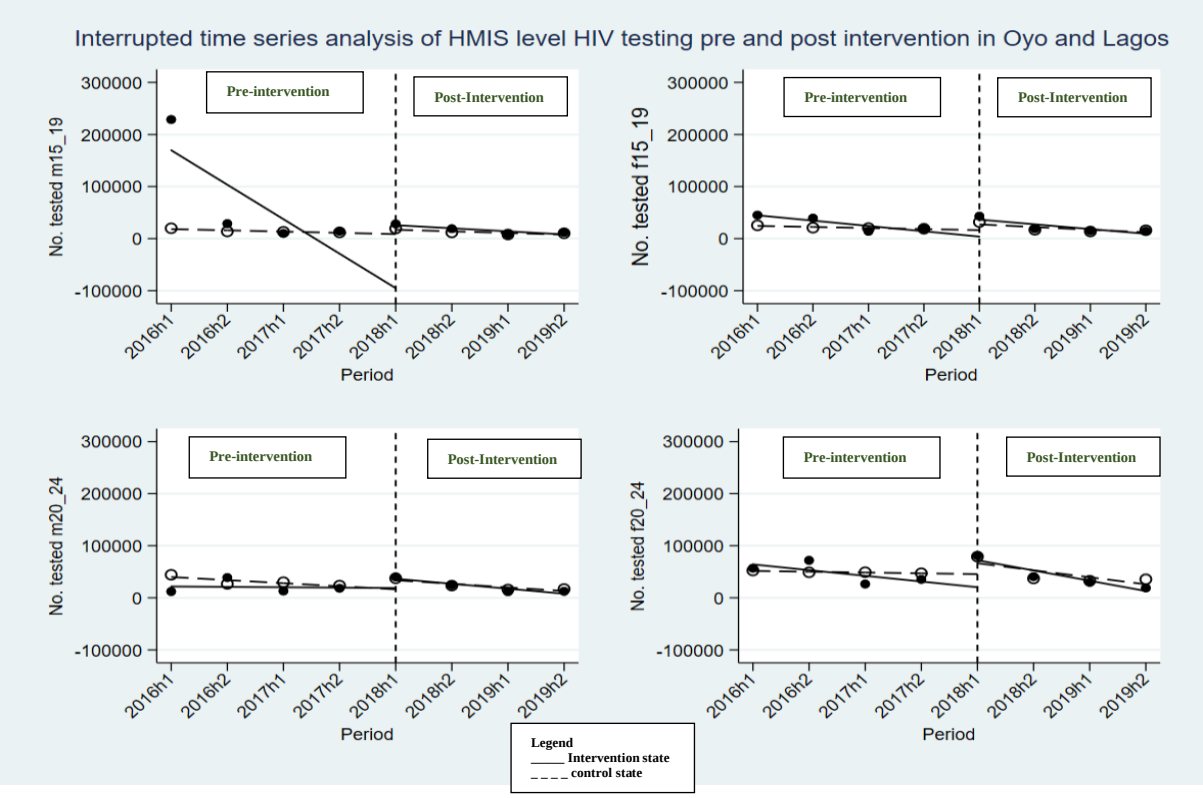
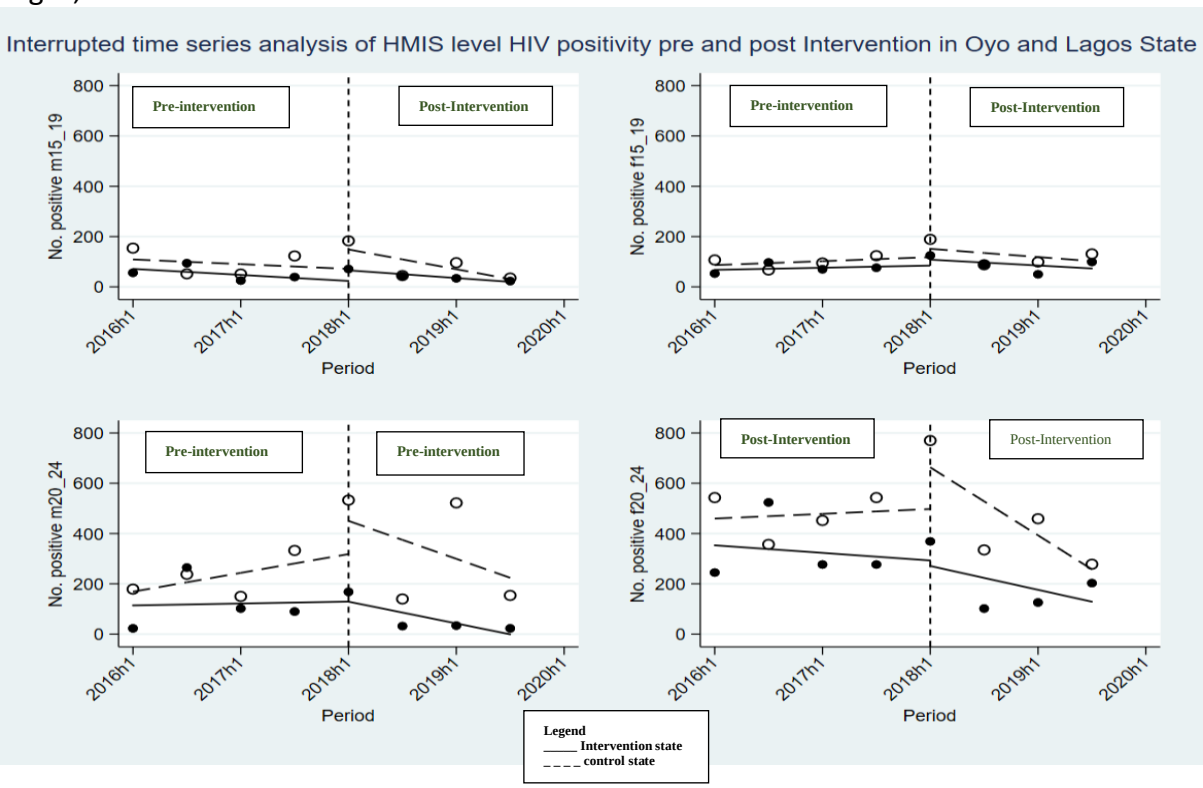


Figure 18: Six-Monthly HMIS Trend analysis for HIV positive cases amongst youths in Oyo & Lagos, 2016-2019



In Oyo state, single regression among females 15-19 years there was a considerable increase in the numbers tested post intervention (B: 5.09, CI:0.14-10.03 <0.04), and statistically significant. (fig 17) In addition, an increased positive number trend was observed post intervention (B:10.6, CI: -7.23-28.4 p<0.15), not statistically significant. (fig 18)
Amongst females 20-24 years a considerable increase in the numbers tested post-intervention occurred (B:7.7, CI:3.74-11.83 p<0.00) and statistically significant. (fig 17) In addition, a tremendous increase in positive number trend was observed post-intervention (B:60.5, CI:24.06-97.03 p<0.01), statistically significant.(fig 18)
There was no substantial gain in the testing and positive trend of the males, except in 15-19 years, there was an increase in the numbers tested post intervention (B:1.65, CI:0.22-3.08 p<0.03), and statistically significant. (fig 17)

The multiple linear regression trend shows that the difference between intervention and control state average was not statistically significant for HIV testing and positive number after accounting for pre and post intervention period. [16]

[16] Annex E2

3.6 QUALITATIVE RESULT

To explain the trend of HTS uptake and positivity yield, six respondents that participated in the project being evaluated, or worked in HIV responds in Nigeria were interviewed. The respondents were 60% females and 40% males. Their highest educational attainment was 10% PHD, 40% master's and 50% bachelor's degree and its equivalents. Their areas of work experience were management (20%), implementation (40%) and both (40%). Years of working experience ranged from 35 to 3 years.
An interview guide (annex B) assisted in exploring their Knowledge of HIV responds, HTS guideline and approach for implementation. List of factors discussed by respondents are itemized in Table 6.

Table 6: Weighting of Key factors identified by respondents

Level of mention by respondents; ***Scale** 1=few, 2=average, 3=A lot		
<u>Proximate risk factors</u> Age=1 Marital Status=3 Educational status=1 Income=2 Occupation=2 Concurrent Partnership =3 Lifetime partners=1 Circumcision=1 Condom use=2 Knowledge of HIV and STI=2 Knowledge of HTS=2 Stigma and discrimination=1 Self-esteem=2 Constitutional factors=2	<u>Intermediate/ Distal risk factors</u> Urban/Rural=1 Religion=1 Ethnicity=1 socio-cultural practices=2 poverty=3 housing=1 food=1 <u>Advocacy and Mobilization</u> Gatekeepers=1 Mobilizers=3 Hotspot mapping=3 Partner notification service=1	<u>Testing</u> Facility testing centers=2 Community outreaches=3 Trained Counsellor testers=3 Commodities=2 Consumables=2 Integration approach for HTS=3 Duration of intervention=2 <u>Management</u> Training=2 Fund availability=3 Communication=2 Sustainability plan=3 close out phase=2 youth friendly centres=2

3.6.1 Factors that explains the trend in HTS uptake and Positivity yield in intervention states.

The theory of change (TOC) was used to organize the information from the interview. The themes covered factors, that may be an enabler or barrier towards achieving HTS outcomes. The result was presented in the order of social determinants (proximate and distal), advocacy & mobilization, and testing requirement. All assumptions that are met or unmet were included. Respondents recommendations for improvement were also included in subsection.

3.6.1.1 Proximate Risk factors

These are immediate cause of HIV transmission and may primarily influence HTS uptake.

- Age

All the respondents reported that youths were vulnerable to SRH diseases including HIV infection. They alluded to how 15 years and above ability to test without consent, gave more flexibility in service delivery to sexually active youths.

- Marital Status

All, respondents noted that unmarried and sexually active adolescents below 18 years, are disproportionately affected in accessing SRHR services.

- Education level

All the respondents agreed that education plays a critical role in getting HIV information. A respondent reported that "*it was generally people with lower educational attainment that had more likelihood to become HIV positive"* (female counsellor tester).

- Concurrent Partnership

All interviewees alluded that this factor is an enabler in uptaking HTS. A participant said that "*females engaging in multiple sexual relationship propelled by the consciousness of their high-risk level to access service*" female counselor tester.

- Lifetime partners

Every respondent agreed that a lifetime partner does not necessarily increase or decrease their risk to HIV, or uptake of HTS, unless they are in a non-exclusive relationship.

- Gender

Most of the respondents stated that women are more likely to test because they are more health conscious. A respondents talked about how females may not be able to test because of cultural or religious reason. *"some may require permission from their male partners to access service*" male counsellor tester

- Male Circumcision

An executive director stated that "*circumcised male may not necessarily have the tendencies to engage in multiple partnership or unprotected sex".* Others did not mention any influence of this factor on risk or HTS uptake.

- Condom use

All respondents allude to the benefit of condom availability to youth as a protective factor to HIV. The free distribution in HTS outreaches was also stated to be a motivating factor to uptake HTS reported effective by 4 respondents.

- Knowledge of STI including HIV

All the respondent reported impressive knowledge of the youths on STI even in low literate.

- Access to HTS

All the respondent made reference to the community approach, moonlight testing, hotspot saturation and contact tracing. For the far and remote communities, CTs were deployed to make services available along with accompanied referral for treatment.

3.6.1.2 Distal Risk factors

These are factors not close to an individual and usually a root cause that influences HIV transmission or HTS uptake.

- Income

All the participants referred to financial dependence on sexual partner as a risk factor to a young girl. Some of the reasons stated were poverty, accommodation and material gains.

- Occupation

The respondents mentioned places known to use cheap labour such as bus parks, shopping malls, recreational centres, street hawking, apprentices, salesgirls and nanny.

- Urban/Rural

Location of residence was a key determinant for uptaking HTS. All the respondents agreed that urban areas are more likely to have access to HTS, as towns are saturated with facilities and outreaches by civil societies and private organizations.

- Religion

Religion affiliation was generally not reported to have any influence in the uptake of HTS across the states.

- Ethnicity/sociocultural

Two respondent mentioned female genital mutilation which can expose young females to an unsterilized sharp object but said it was very rare nowadays. On the protective note, a respondent reported that ethnic expectation on virginity and acceptable behaviours could motivate some females to avoid sexual activities and risky social behaviours like drug abuse.

- Stigma and discrimination

All the participants alluded to the effect of stigma in HTS uptake. *"The primary health centres are sometimes not too friendly for adolescents to uptake family planning commodities e.g condom"* by Female counsellor tester. For STI treatment it's difficult for young people to go due to the judgment attitudes. Half of the respondent referred to this facility gap as an influencing factor to the high uptake of the mobile STI treatment and HTS in the community.

3.6.1.3 Advocacy and mobilization

- WHEN to conduct the advocacy and mobilize

The participants noted that advocacies are done to enable CTs engage gatekeepers in planning for HTS to be done when the youths are available. The youth mobilizers use the information to plan for the behavior change communication (BCC) sessions.

- WHERE to advocate and mobilize

In executing targeted testing, the respondents noted the importance of knowing where to find the high-risk females. *"This involves knowing where they reside, interact and socialize"* said a program manager. A mapping exercise gave the information on hotspots, then HTS was deployed.

- WHO to advocate and mobilize.

In the community, decision makers, traditional institutes, implementing partners and youths were advocated to for collaboration. The respondents noted that profiling based on lifestyle e.g multiple partnership, concurrent sexual partners, working in risky location like bars, clubs and bar restaurants was strategic to the project success.

- WHAT to advocate and mobilize for.

The respondents mentioned that the targeted approach was aimed at few testing's but more towards finding those likely to be HIV positive. The respondents from the state government mentioned that the facility based were more for walk in clients and routine health needs that may require provider-initiated HTS.

3.2.1.4 Testing activities

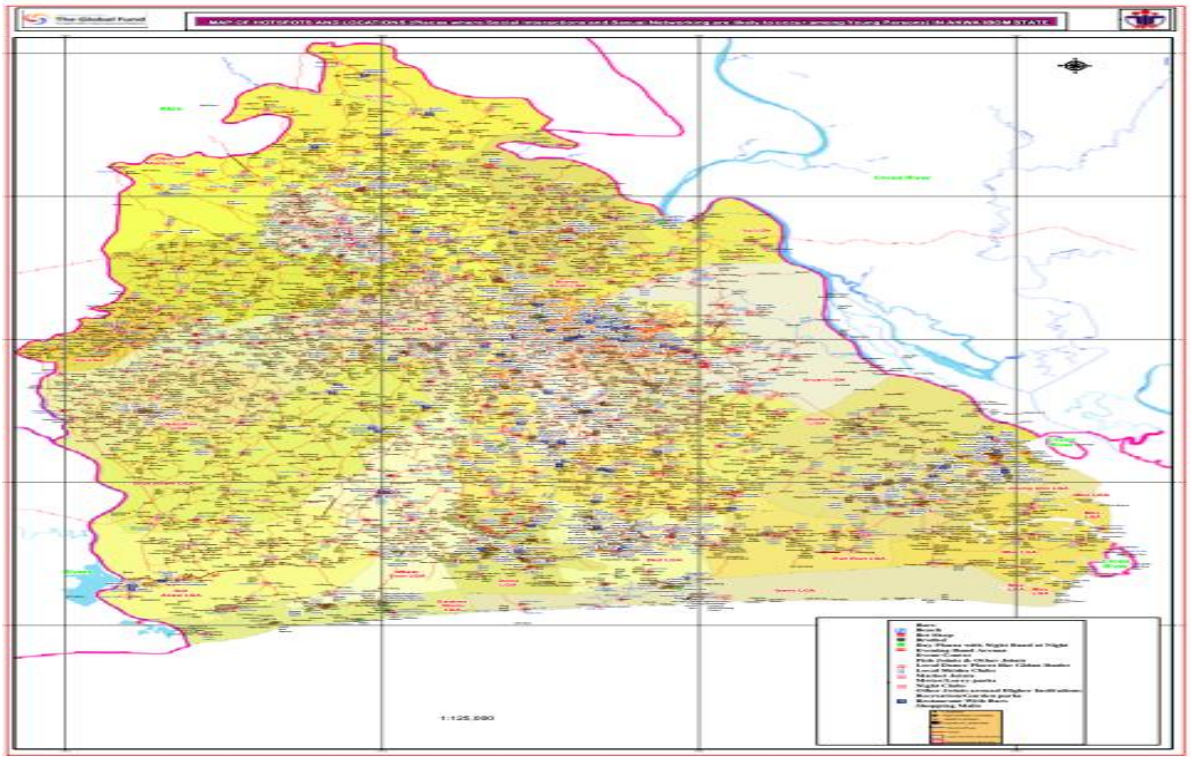
- Hotspot mapping

The respondents laid emphasis on the use of the action research findings on adolescent girls and young women's vulnerability factors to map hot spots. These factors (Table 7) were used to develop a Geographic information system (GIS) map used in the targeted testing (figure 19).

Table 7: Showing the vulnerability factors identified to pre-dispose adolescents girls and young women to HIV in selected sates of Nigeria (64).

• Transactional sex • Inter-generational sex • Low personal HIV risk perception • Multiple concurrent sexual partnership • Substance abuse/use • Incest • Other forms of sexual violence • Homelessness • Poverty • Lack of family support • Breakdown of family structure • Gender Based Violence- (Sexual Violence, Physical Violence, Economic Violence, Psychological/Emotional Violence, Forced sex/rape)	• HIV related stigma and discrimination • Single motherhood • Teenage pregnancy • Early sexual debut • Pornography • Pressure from peers/outside influence • Sexually transmitted infections • Being out of school • Being a displaced person • Being away from home • Poor services for STIs • Persons with disabilities • Harmful Traditional Practices (Child marriage)

Figure 19: Hot spot mapping of Akwa-Ibom state. (64); Abuja and Oyo maps are in annex C



- Partner notification service

The respondents reported that that PNS identified partners of positive clients who were comfortable to fully or partially disclose. A female counselor tester stated *"most of the HIV positive clients were not ready to open up about their HIV positive status. Some said it will have an effect on their relationship, so their decision had to be respected.*

- Facility testing centers

It was reported that Health facilities were used for linkage of HIV positive persons to treatment. In the rural areas it was difficult, because of the sparse distribution of the health facility. "*there was collaboration between the mobile team and the facilities, referrals made from the field to the facilities when needed"* (*female* programme manager).

- Community outreaches

According to the respondents, transportation fare and time taken to access services was reduced with outreaches.

- Trained Counsellor testers

All the CTs were selected from the community and within a youth age category. They were all trained by the Ministry of health on how to do youth friendly counselling and testing for 4 weeks.

- Commodities & Consumables

A respondent also reported procurement delay, which was controlled by the contingency plans of the implementing organization. Another respondent noted that, the flow of test kits for youths was disrupted after the project ended as the state government have very limited test kits.

- Integration approach for HTS

The respondents reflected on integration of the HTS to STI, TB, cervical cancer and malaria outreaches to improve testing uptake. A program officer stated that male youths expressed displeasure for not being a priority in the health education sessions even though they were offered free STI treatment and condoms during outreaches.

- HIV Response

A CBO manager noted the over dependence on donor's funds for HIV interventions among youths, as unsustainable. Another respondent noted the shift in implementation timeline from 24 to 18 month as improper in addition to no exit phase.

- Sustainability issues

The limited resources outside the donor fund were stated as a major setback for youths in the states.

CHAPTER 4- DISCUSSION

This section interprets the findings in relation to the effect of targeted versus non-targeted approaches on HTS uptake and positivity yield. Qualitative findings and literatures were used to explain the findings at the project and state level. The discussions were organized by key findings from the trend analysis. The relevance of the theory of change was illustrated within the discussion.

Effect of intervention on HTS uptake and positivity yield at the Project level

The quantitative component of this study demonstrates that the intervention had a statistically significant effect on HTS uptake particularly among female youths. For the male youths, there was no demonstrable influence. The main reason for the statistically significant increase in HTS uptake amongst the females than males may be due to the fact that targeted approach was only implemented in females. The effects were more pronounced among older females aged 20-24 years, compared to the young adolescents. The observed effects of this intervention could have been due to the evaluated project. This is due to the robust, scientifically sound methods, such as the moonlight testing technique, employed by the project. Literatures suggests that this strategies are effective in reaching high risk youths. (3,35,70,71)

This finding was corroborated by statements from the participants in the qualitative study. For instance, a program manager stated *"the use of moonlight testing in addition to the behavior change communication (BCC) session, helped with meeting the right targets and achieving the testing numbers and positivity yield*. This also agreed with findings from previous studies. For instance Charles et, al 2017 and Nnko et, al 2019 who reported the effectiveness of moonlight testing and BCC session in HTS uptake. (70,72) Other studies that explored targeted approach were also consistent with these outcomes. In a cross-sessional study by Esteban-Vasallo et al, 2013, it was reported that the program achieved more HTS uptake and positivity yield amongst key population in Madrid. (25) Gbadamosi et al.2019, in a study conducted amongst pregnant women in Nigeria, found a significant increase in the uptake of HTS among male partners. (73)

Another reason for the observed high testing effects, among older females in the current study, could have been due to the presence of higher risky behaviors, among youths aged 20-24 years, compared to younger ones in Nigeria (6,52,74). They are more likely to be in sexual relationships and to have multiple sexual partners than the younger females (6,52). These factors are indeed an enabler in utilizing HTS. In fact, a female counselor tester reported that "*The self-awareness of girls with multiple concurrent partners motivated them to uptake HTS*. *This was propelled by the consciousness of their high-risk level".*

Integration of HTS delivery with other services was reported by the respondents to have enhanced the intervention HTS uptake rate. Activities such as cervical screening, STI and malaria outreaches were partnered for increased project output. Additionally, the fact that targeted HTS involved free condom distribution and concurrent STI treatment with free medications, could have accounted for the increased uptakes, recorded in this study. This was supported studies on youth friendly service delivery (36,52,75,76) and statement from a

female Project Officer who opined that *the project inclusion of syndromic management of STI including free drugs, condoms were very helpful in improving their knowledge and in getting them to access HTS during the integrated outreaches.*

Another key finding was an increase in positivity yields but this was only statistically significant in Akwa-Ibom state. The reason for this could be due to higher HIV prevalence in the state compared to other states (17). Results from the qualitative study was in support of this finding. The majority of respondents, reported more adolescent girls in Akwa-Ibom state to have a low literacy rate, they engage more in petty businesses and risky occupations than other states. This places them at an increased risk of sexual abuse(37).

The females in the state were more likely to have multiple sexual partners compared to girls in other states(77). This is partly because of the oil-exploration activities taking place in the state, which attract workers from different parts of the countries, some of which take transact sex with the young girls. (29,78,79) This was also consistent with study amongst male partners of HIV positive pregnant women in Nigeria. A high prevalence outcome was documented with a positivity yield of 37.7%. (73) This supports another study that expressed that new infections happens more in women engaging in multiple and concurrent partnerships (25,80–82). On the contrary, religion and ethnic group affiliation is known in this state. (78) A respondent reported that ethnicity, religious teaching and values from family was a protective factor to some females who expressed delaying sexual debut.

The reason for the non-significant positivity yield in the Oyo and Abuja states could be due to not implementing the strategies for targeted approach in the right way and/or generally due to low HIV prevalence in the state. For instance, not correctly using the mapping of the hotspots, predisposing females to HIV infection, was reported as a programme deficiency in Oyo State by a male counsellor tester " *the CBO contracted for health education and mobilization for testing were more focused on the reaching the testing number at the beginning, we had to strategize towards the end to profile well and do the targeted approach.* This reason does not have too much weight, as was only mentioned by a respondent.

The current study equally revealed that a geographical variation in HTS utilization and positivity yields. While appreciable increases were recorded in both Abuja and Akwa-Ibom respectively at post-intervention, there was no major change in the trend of HTS uptake and positivity in Oyo State. This can be explained by the obvious disparity in the socio-economic contexts in the different geopolitical zones of Nigeria. (9) The qualitative finding attributed the higher socio-economic activities taking place in both Abuja and Akwa-Ibom as possible reason for the discrepancies in programme outputs. This was in keeping with findings from previous Nigerian studies which established a socio-economic variation in geographical location to influence HIV prevalence (7,38,72)

Another reason mentioned by respondents for the geographical variation in outcome was the presence of stigmatization and lack of confidentially in some health facilities. This finding was collaborated by studies that established that service provision at youth centres in community, groups and facility by familiar faces, may not always be ideal for uptake because of stigma, privacy and confidentiality. (33,52)

One of the drawbacks of the targeted approach, observed in this current study, was the apparent diversion of attention and resources from the males to the females especially in Abuja. HTS uptake amongst the males in the pre-intervention phase sharply went flat after the intervention started. This scenario observed could cost the state to lose its gains amongst the males with regards to HIV transmission(3,35). Even though testing dropped significantly amongst male, HIV positivity yield was 3 times better in the post-intervention phase amongst them, although it was not statistically significant.

The new positives found in males can also be attributed to the intervention. Reason being that partner notification service (PNS) was explored by the project. In addition, males were been offered services at the hotspot, mapped for the high risk females (61). Although, the PNS was reported by the respondent to be difficult in operationalizing. It is impediment to note that the WHO guideline, of providing HTS services, that is free of coercion, was abided to a great extent by the project implementers. Pressure to implement contact tracing, towards improving uptake and positivity yields, should not violate the youth's privacy and human rights. (3,27,81)

In summary, the intervention had some statistically significant effect on HTS uptake but more in positivity yield particularly among female 20-24 years in Akwa-Ibom. With the effect of the targeted approach being ascertained on this outcomes, the cost effectiveness was not known. This study findings recognized that the use of effective strategies such as hotspot mapping, risk profiling, contact tracing, moonlight testing, integrated service and saturation of yielding hotspots helped with the positivity yield.

Effect of intervention on HTS uptake and positivity yield at the state level

As a reminder, the HMIS level findings has the project data as a subset of its data. Going forward, the HMIS finding will be referred to as the state finding. The most significant result was observed in Akwa-Ibom State, where the contribution of the project to State-level uptake of HIV testing among young women increased from 5% to 30%, after introduction of the targeted approach.

The main explanation for the large project contribution during the targeted phase in Akwa-Ibom, was because of the large programme testing allocation from the project protocol (44,1018 in Akwa-Ibom Vs 11,075 in Oyo and 8,519 in Abuja)(9). This allocation was based on the states HIV prevalence in the state, of which Akwa-Ibom is the highest HIV burdened stated in Nigeria (17). Another reason for the steady project contribution to testing in both Abuja and Oyo, maybe due to the fact that targeted approach drive more towards testing people who are more at risk of being HIV positive rather than mass testing. (3,9)

Accounting for the control's states, the contributions from the intervention states was generally not statistically statistically post-intervention. But statistically significant result in positive number was seen amongst 20-24years in Akwa-Ibom.
The reason for this it could be due to double counting of data. Taking into consideration that when the result was controlled there was barely a statistically significant increase positives

and testing in other intervention states. Although the "number tested" represented people who had tested and received their result; and "number positive" represent people who tested HIV positive for the first time. There is possibility of double counting of this output indicators. It is very common for people to re-test for HIV at any time, especially when they hope for a different result or have any risk factor. This can contribute to increase number of reported positive amongst certain groups. Also, the qualitative findings suggest that there was periodic shortage of test kit in the country. This could be partially alluded to low uptake in state level. A government official, stated *"we have been struggling for a while with having enough test kits in all our facilities. This stock out affects the testing coverage, we now prioritize for pregnant women and the key populations".*

In contrast, there was a drop in project contribution in Akwa-Ibom from 29.8% pre-intervention to 20.8% post-intervention. The reason could be due to presence of other interventions contributing a lot to HIV positive case finding. (77,83) In absolute numbers, the state and project levels had more HIV yield at post-intervention than pre-intervention but the proportion of contribution clearly showed that more actors started working at the post-intervention. This finding can be alluded to the direction given to implementing partners to focus on high prevalence states based on the programmatic focus of the Nigerian and American partnership to fight HIV/AIDS through the PEPFAR fund. This direction document classified Akwa Ibom and Rivers as the surge states i.e low saturation with high unmet needs. (83).

Another finding was that females 20-24 years had both statistically significant HTS uptake and positivity yield in all the states. This is in tandem with the finding at the project level which was most statistically significant in this age group. The reason for this could have been due to the sexual activity and orientation. (72,81) Literatures suggest that preference for oral, anal or vaginal sex increases the risk of contracting HIV especially among young girls with low self-esteem. (84,85) The more body fluids (such as Semen) contact during sexual activities with an infected person, the more the risk of HIV transmission, especially for females. (6,52,79,86)

Arguably, multiple sexual partnership was the most influencing factor HIV mentioned by the respondents. The reasons listed were poverty, housing, food and lifestyle. This was supported by studies reporting concurrent sexual partnership as influencing factor for HIV acquisition amongst youths (37,52,84,87). The sexual partners are sometimes much older than the girls which affects negotiation for condom use. (37,52,87) A respondent also alluded gender playing a role in the higher HIV presence amongst females. For example, HIV positivity yield in Akwa-Ibom was 10 times more than Oyo post-intervention. Akwa-Ibom riverine areas is known for high HIV positivity (78). A respondent confirmed that women and girls in riverine areas engages in a lot of sea product selling. This gender role pre-disposes them to transactional sex. Eleanor et al, 2012 demonstrated in an exploratory study that fish buyers in southern Malawi, transact sex for affordable price from the fishermen (79)

Beyond sexual activities, other biological risk factors may be amplified in young women. The biological pathways in males have more protection due to penis foreskin and narrow urethra, (88) while the female's open cervix increases mucosal exposure to semen (41,89). In relation to early sexual debut and age, younger adolescents are more at risk than older ones, because of an immature cervix surface and tendency for inflammation during sexual acts. (41)

The project provision of training on income generating activities (IGA) to high risk females was strategic for mobilization for HTS, thereby improving positivity yield. This findings was collaborated with a study by Black et,al 2014, which reported that incentives as a point base rewards system in youth centres improved HIV testing amongst South African boys. (90) This study could not establish that the project's use of training on IGA and financial incentives can be attributed to reduce risky behaviour and effective mobilization for improved HTS in Nigeria context. More studies are required to ascertain this correlation .

In conclusion, the state level findings support that targeted approach of testing was effective at the project level. The dynamics seen in Oyo and Abuja, justifies that targeted approach's effect in identifying new HIV positive but primary attribution cannot be made due to data limitation.

Strength and Weakness of the theory of change

The temporal trend within the project and state levels were different because of several underlying factors working in a mix to influence the changes observed. Firstly, the targeted approach in the project influenced a lot of the significant difference. It established that proximate, distal, advocacies, mobilization, testing activities and assumption should be considered to inform testing approach options. Findings from the KII participants was able to appreciate the guidance of the TOC. They explored enablers and barriers factors that were within the TOC framework. Also, other studies validated the factors as important risk factors for HIV transmission and HTS uptake (44,54,91,92).

Reflecting on this assessment, ethnicity and religion did not give much information to the findings. For improvement, the TOC can explore more on the presence of gender based violence, project management, stakeholder's collaboration, close-out activities, and sustainability plan. Other components not covered but reported in literature to influence risk level and uptake of services were, presence of youth friendly centres, urbanization, and training on income generating activities.

4.2 Conclusion

Having assessed the process and outcome of this project. The uptake of HTS and positivity yield had improved in youth groups and states at different levels in Nigeria. The findings from this evaluation have reflected on the research questions and established some resolutions.

The projects contributed to the intended outcomes nationally, with very impressive results at the project level. Maybe if it was at a larger scale, the effect at the state level would have been more prominent. But in all, the project has contributed to intended outcomes (improved uptake of HTS, improved positive yield) in the short term. In the long term, this effects can be sustained if the contact tracing and risk profiling are scaled up to the 36 states with focus on the high prevalence communities and groups. This will supplement the facility based and other community outreaches and in the transmission of HIV will reduce, provided identified positive clients are linked to treatment and sustained.

Regardless of the approach deployed for HTS, youths are more likely to uptake service when it is available and at their convenience. In addition, females with higher risk of contracting HIV, requires the presence of the targeted approach to uptake service in a seamless manner. The convenience that came with the targeted approach on this project giving more room for youths to uptake HTS. For example, providing a wide range of services at any time of the day and place in addition to accompanied referral when preferred by the youth was very innovative.

The project activities were systematic and evidence driven. The action research which unravelled the predisposing factors of the adolescent girls and young women to HIV was also very important to the success of the targeted approach. Through the use of the action research findings to map the hotspots within the communities. The findings were also used by the CBOs to strategies their community engagement. The active engagement of the youths, community and government stakeholders in the programme implementation, was also very strategic to the success of the project. The engagement of young people as counsellor testers, and youth lead CBOs as community advocates and mobilizers, was also pivotal to the success.

In conclusion, the targeted approach of deploying HTS, can be effective in the long term when underlying risk factors in context are identified to drive implementation. To move towards the universal health coverage and the UNAIDS target for 2030, the SRHR needs of Youths must be prioritized.

4.3 Recommendations

This section itemizes recommendations based on findings and best practises to specific stakeholder.

Government

- **Commodities availability:** The periodic shortage of HTS commodities especially testing kits and condom needs to be addressed at the national level. Funding disbursement, procument time and distribution chain management were amongst the reasons for the persistent shortage. Unfortunately, the youths and the general population are most affected. The key population sometimes had stock out in some location, but they were usually prioritized.
- **Sustainability plan:** The short term phase of intervention amongst youths was not ideal and it can be difficult to maintain the gains. The ministries and agencies for the control of AIDS, need to take up a more prominent role in ensuring continuity of the youth's interventions. This can be achieved by providing support to CBOs, to serve as a sustenance body in the community. Finally, health programs for youths should be more integrating and prioritized in all grant making opportunities as they are a diverse population with social and sexual network in every groups.

Donor

- **Management:** Evidence suggests top-bottom approach of decision making in the project implementation. For example, the timeline in the project implementation plan was compressed from 24 months to 18 month without exit phase, due to several reasons alluded to donor demands. The absence of an exit phase affected the close out of the project. Such abrupt end in activities contributes to the weakness of the health system. Future plans should be more flexible and long term focused.
- **Inclusion of male youths in intervention** is recommended to sustain the gains of the project. A holistic approach is best for HIV eradication. The epidemiology is not static; vulnerability can shift to unprotected groups. HIV prevalence is increasing in young MSM's, and most of the time they are bi-sexual due to same sex laws criminalizing homosexuality in Nigeria. This encourages adopting a bisexual lifestyle. This makes the transmission cycle more complex for pocket intervention and targeting the females only.

Civil societies

- **Youth friendly centres:** The need of this service centres around quality and responsiveness to health needs of youths. Future interventions should implore integrated approach in implementing youth centres to assure sustainability. This seems to be more sustained in the long term approach. This could also contribute to revitalizing of the weakened primary level of care on Nigeria. Finally, context specific needs should be focal at all times, as needs varies from geographic location to another.

Research

- **Use of Cash transfers as incentives** for high risk young people to take up health services and safer behaviour is recommended for further study. The use of direct cash transfer has been reported in literatures to be effective among high risk groups in other African countries. Although this may be difficult to sustain in the Nigerian context, it's worth the try, for specific groups, engaging in transactional sex. Even though findings from this study, suggest that accompanied linkage to services, waiver for hospital user fee, free provision of STI drugs and condoms for the youths could be effective in adoption of the health behaviour, more research is needed.
- **Cost effectiveness;** the cost effectiveness of this study is recommended, to enable large scale implementation
- **Impact study**- having established the effectiveness of this study, there is need to conduct an impact study after 5 years to ascertain the true extent of the impact in trend analysis that will be built on this effect study.

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Annex

Annex A: Informed Consent form for Key Informants

(Source: WHO 2018, ICF template for qualitative studies, Reference no. 17)

This informed consent form is for Health professional above the age of 18 years in Nigeria, whom we are inviting to participate in qualitative research titled "Comparative Assessment of Targeted and Non-targeted HIV Testing Service Approach amongst Youths in selected state of Nigeria".
Name of Principal Investigator: Musili Eyihuri Abubakar; Name of Educational Institution: Royal Tropical Institute (KIT), Netherlands.

This Informed Consent Form has two parts: Information Sheet and Certificate of Consent. You will be given a copy of the full Informed Consent Form.

Good morning/Good afternoon,

Part I: Information Sheet

My name is_____, I am a student at _____and currently doing a study to evaluate Targeted and Non-targeted approach of HIV Testing Service amongst youths in selected state of Nigeria.

I am inviting you to be part of this study. This consent form may contain information that you do not understand. Please ask me anytime and I will take the time to explain.

Purpose of the research: Our purpose for this study is to assess the relationship between targeted and non-targeted HTS amongst youths testing and HIV positivity yield in Selected states and make recommendation for further programme in Nigeria. We believe that you can help us by telling us what you know about the problem of Youths 15-24 years. This information will help us to learn about this problem and make recommendation.

Participation: This study will involve your participation in an interview that will take about a one-hour. You are being invited to take part in this research because we feel that you have the knowledge and experience that can contribute much to give better understanding of this problem. Your views and opinions are also very important. Participation in this research is entirely voluntary. It is your decision to participate or not. If you choose not to participate, it is within your right. You are also free to change your mind later and stop participating even if you agreed earlier. There are no consequences to do so.

Procedures of Interview and Confidentiality: Virtual format o interview would be used due to the Covid-19 lock down. Zoom or Skype platform will be used to facilitate the interview. The information will be treated with confidentiality at all time. It will only be available to the research team involved in this study. The entire interview will be noted and- recorded if you permit it, and no-one will be identified by name during recording.

Risks and Benefits: We are asking you to share some professional experiences and confidential information with us, and you may feel uncomfortable talking about some of the topics. You do not have to answer any question above your experience or professional knowledge. You do not have to give us any reason for not responding to any question nor consequences for your reputation and otherwise. There will be no direct benefit to you, but your participation helps us understand how HTS should be delivered and make recommendations.

Results sharing: After the study is completed, we will share the results with Ministry of health, community and relevant organization through workshop, conference and media. We will also publish the results so that other interested people may learn from the study. If you would like to receive a copy of the report, please let us know and we will send it to you.

Contact: If you have any questions, you can ask them now or later. If you wish to ask questions later, you may contact any of the following:_____ [Name, address/telephone number/e-mail].

This study has obtained a waiver for full ethical review by the Research Ethical committee of Royal Tropical Institute (KIT). This waiver has been obtained because all interviewees are being asked questions in their professional capacity only and not any personal questions.

If you wish to talk to the committee about any issue concerning the research, please contact:_____[address/telephone number/e-mail].

Part II: Certificate of Consent

I have been invited to participate in a study about the "Comparative Assessment of Targeted and Non-targeted HIV Testing Service (HTS) amongst Youths in selected state of Nigeria" The purpose of the interview and all details mentioned were explained to me and I consent voluntarily to be a participant in this study.

Name of Participant_____Signature of Participant _____

Date _____ Day/month/year.

Statement by the researcher/person taking consent: I have accurately read out the information sheet to the invited participant, and to the best of my ability made sure that the participant understands all information above mentioned. I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

A copy of this Informed Consent Form has been provided to the participant.

Name of Researcher _____

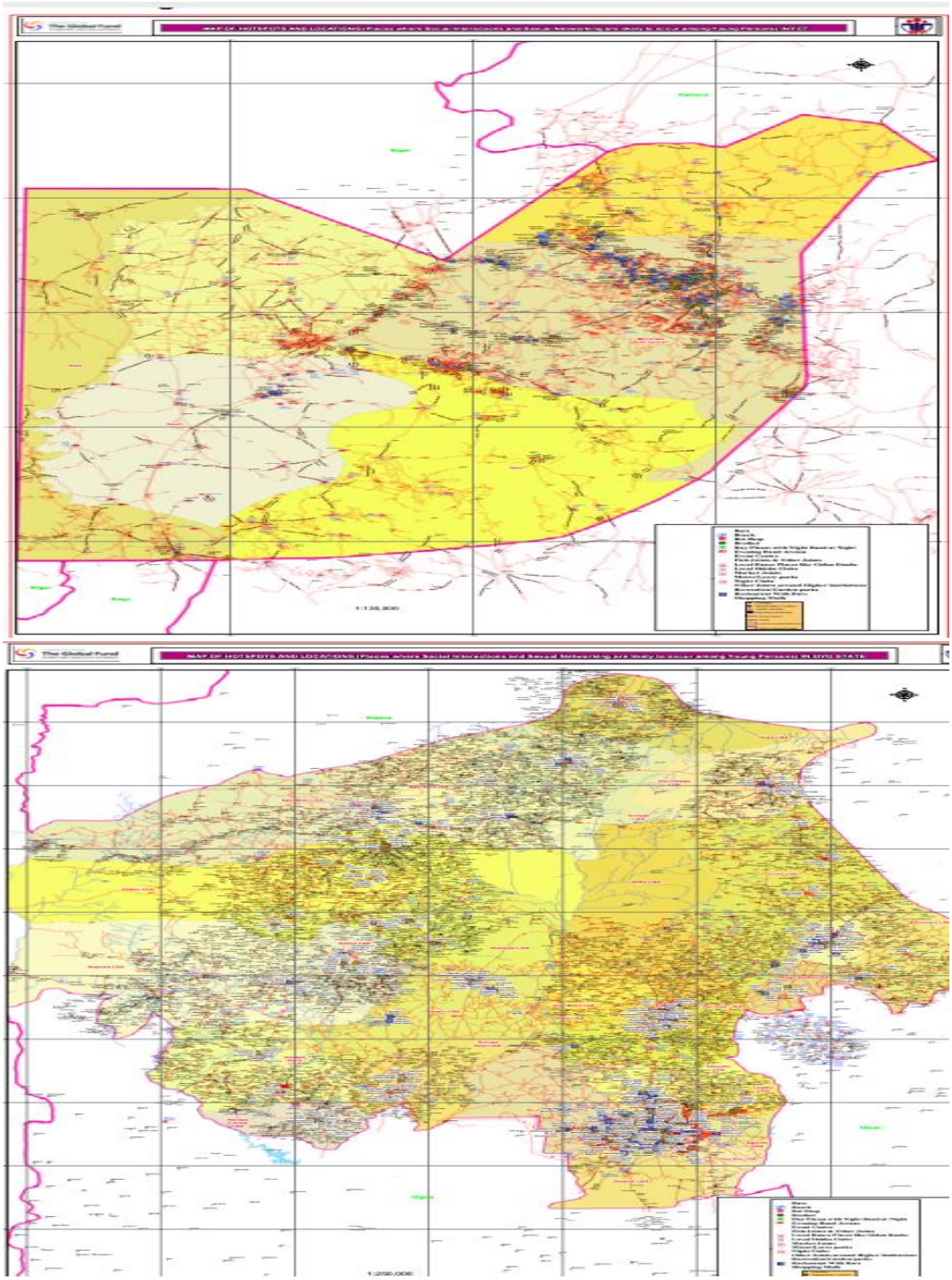
Signature of Researcher _____

Date _____ Day/month/year

Annex B: Key Informants Interview Guide

	Interview Guide	
	Topic	Sub-issues- Please answer the following questions?
1	Demography/History	Could you introduce yourself by providing information for; Age, Sex, Qualification, Areas of experience, Years of experience
		What is your career background in Public health (discuss by programmes, duties and years)
	Introduction	What was your job description at the society for family health (SFH) or the state Agency for the control of AIDS (SACA)
2	Explore experience of the Programmers	How was the Adolescents and Young People (AYP) project implemented by the SFH in your region OR How is the SACA programme addressing HIV amongst youths in your region?
		Based on your professional experience, how does this determinants influencing HTS uptake amongst the youths; <u>Distal factors (explain for each differently)</u> Age Marital Status Educational status Income Occupation Urban/Rural Religion Ethnicity socio-cultural practices <u>Proximate risk factors</u> Concurrent Partnership Lifetime partners Circumcision Condom use Knowledge of HIV and STI Knowledge of HTS
		Based on the draft findings of this research reflect on your experience/expectations for the SFH project? Were there any missing links or best practices in the following building block to successful testing. Advocacy and Mobilization Hotspot mapping Partner notification service Facility testing centers Community outreaches Trained Counsellor testers Commodities Consumables Integration approach for HTS
		What recommendations do you have on improving the draft finding based on your experience on the project

Annex C: Map showing the hotspots predisposing the adolescent girls and young women to HIV in Abuja and Oyo.



Annex D; Single Linear trend Regression of Monthly Program data for HTS uptake and Positivity yield for the period of 2016-2019

Postintervention Linear Trend: 699							
States	Treated	Coeff	Std. Err.	t	P> |t|	[95% Conf.	Interval]
Abuja		0.1536	0.5209	0.2948	0.7698	-0.9019	1.2091
Akwa-Ibom	ttested_prog_m15_19	-4.225	3.8592	-1.0948	0.2807	-12.0444	3.5944
Oyo		-0.5286	1.4422	-0.3665	0.7161	-3.4508	2.3936
Abuja		-0.0214	0.0296	-0.7246	0.4733	-0.0814	0.0385
Akwa-Ibom	tpos_prog_m15_19	0.1464	0.0745	1.9642	0.0571	-0.0046	0.2975
Oyo		0.0143	0.0221	0.6465	0.5219	-0.0305	0.0591
Abuja		2.8	7.3488	0.381	0.7055	-12.1189	17.7189
Akwa-Ibom	ttested_prog_f15_19	-2.1	34.826	-0.0603	0.9523	-72.8001	68.6001
Oyo		12.1821	10.13	1.2025	0.2372	-8.3837	32.748
Abuja		-0.1071	0.0865	-1.2392	0.2235	-0.2827	0.0684
Akwa-Ibom	tpos_prog_f15_19	1.4857	0.4379	3.3928	0.0017	0.5967	2.3747
Oyo		-0.025	0.1342	-0.1863	0.8533	-0.2974	0.2474
Abuja		0.9679	2.7446	0.3526	0.7264	-4.5933	6.529
Akwa-Ibom	ttested_prog_m20_24	-1.7429	11.516	-0.1513	0.8805	-25.0774	21.5916
Oyo		-7.4821	3.0848	-2.4255	0.0203	-13.7325	-1.2318
Abuja		-0.0214	0.0264	-0.8119	0.4221	-0.0749	0.0321
Akwa-Ibom	tpos_prog_m20_24	0.1393	0.1732	0.8041	0.4265	-0.2117	0.4903
Oyo		-0.2143	0.0599	-3.5779	0.001	-0.3356	-0.0929
Abuja		-0.8964	7.7735	-0.1153	0.9089	-16.6775	14.8847
Akwa-Ibom	ttested_prog_f20_24	189.743	63.178	3.0033	0.0049	61.4852	318.0005
Oyo		50.2964	29.217	1.7215	0.094	-9.0179	109.6108
Abuja		0.5607	0.3717	1.5085	0.1404	-0.1939	1.3153
Akwa-Ibom	tpos_prog_f20_24	13.5214	3.4343	3.9372	0.0004	6.5494	20.4934
Oyo		1.9321	1.0638	1.8163	0.0779	-0.2275	4.0918

Annex E1: Single linear Regression of HTS uptake and positivity yield at the HMISlevel by intervention states compared to control states 2016-2019

Postintervention Linear Trend: 116							
State	Treated	Coeff	Std. Err.	t	P>t	[95% Conf.	Interval]
Abuja	proptested_m15_19	0.7345	0.3392	2.166	0.119	-0.3449	1.814
Akwa-Ibom		3.3607	1.5531	2.164	0.1191	-1.5821	8.3035
Oyo		1.6559	0.4494	3.684	0.0346	0.2256	3.0861
Abuja	proppos_m15_19	3.2367	2.3987	1.349	0.27	-4.397	10.8704
Akwa-Ibom		2.972	1.9773	1.503	0.2299	-3.3207	9.2647
Oyo		1.4706	1.9824	0.742	0.512	-4.8384	7.7796
Abuja	proptested_f15_19	7.198	2.3997	3	0.0577	-0.4389	14.8349
Akwa-Ibom		16.3949	5.162	3.176	0.0502	-0.0331	32.8228
Oyo		5.0924	1.5545	3.276	0.0466	0.1453	10.0395
Abuja	proppos_f15_19	3.6858	2.2174	1.662	0.1951	-3.3708	10.7424
Akwa-Ibom		11.6437	5.7198	2.036	0.1346	-6.5594	29.8468
Oyo		10.6	5.6045	1.891	0.155	-7.236	28.436
Abuja	proptested_m20_24	2.1335	1.2104	1.763	0.1762	-1.7185	5.9854
Akwa-Ibom		4.8843	2.7455	1.779	0.1733	-3.8532	13.6218
Oyo		4.5832	0.6402	7.159	0.0056	2.5457	6.6206
Abuja	proppos_m20_24	0.284	0.5978	0.475	0.6672	-1.6185	2.1866
Akwa-Ibom		0.5104	0.9616	0.531	0.6323	-2.5498	3.5707
Oyo		4.6744	8.7647	0.533	0.6308	-23.2187	32.5674
Abuja	proptested_f20_24	5.7218	0.8858	6.459	0.0075	2.9027	8.5408
Akwa-Ibom		-26.2479	19.9405	-1.316	0.2796	-89.7076	37.2118
Oyo		7.7919	1.2704	6.133	0.0087	3.7489	11.835
Abuja	proppos_f20_24	16.3814	2.9366	5.578	0.0114	7.0358	25.727
Akwa-Ibom		27.4937	0.3282	83.77	0	26.4492	28.5381
Oyo		60.5497	11.4631	5.282	0.0132	24.0691	97.0304

Annex E2: Multiple Linear trend Regression of HTS uptake and positivity yield at the HMIS level by intervention states compared to control states 2016-2019

	Linear Trend	Coeff	Std. Err.	t	P>t	95% Confidence Interval	
tpos_nat_m15_19	Abuja	-2.53E+03	472.1762	-5.3592	0.0007	-3.62e	-1.44E+03
	Nasarawa	-4.23E+03	795.1582	-5.3232	0.0007	-6.07e	-2.40E+03
	Difference	1702.3	924.7848	1.8408	0.1029	-430.2576	3834.8576
ttested_nat_m15_19	Abuja	-9.1	1.1141	-8.1681	0.000	-11.6691	-6.5309
	Nasarawa	-30.8	13.3369	-2.3094	0.1214	-61.5549	-0.0451
	Difference	21.7	13.3833	1.6214	0.1436	-9.1621	52.5621
ttested_nat_f15_19	Abuja	-5.88E+03	35	-42.1716	0.0000	-6.20E+03	-5.56E+03
	Nasarawa	-4.16E+03	-1.7326	0.1214	1.21E-01	-9.69E+03	1375.35
	Difference	-1.72E+03	-0.7164	0.4941	0.4941	-7.26E+03	3819.08
tpos_nat_f15_19	Abuja	-35.4	3.7018	-9.563	0.000	-43.9363	-26.8637
	Nassarawa	-43.2	31.5103	-1.371	0.2076	-115.8629	29.4629
	Difference	7.8	31.727	0.2458	0.812	-65.3626	80.9626
ttested_nat_m20_24	Abuja	-6.27E+03	991.0921	-6.3286	0.0002	-8.56e	-3.99e
	Nassarawa	-5.09E+03	407.8648	-3.6175	0.0068	-8.34e	-1.85e
	Difference	-1.18E+03	1721.7278	-0.6849	0.5128	-5.15E+03	2791.1115
tpos_nat_m20_24	Abuja	-49.6	2.7054	18.3337	0.000	-55.8387	-43.3613
	Nassarawa	-64.1	24.7855	-2.5862	0.0323	-121.2555	-6.9445
	Difference	14.5	24.9327	0.5816	0.5769	-42.9949	71.9949
ttested_nat_f20_24	Abuja	-7.81E+00	32705.75	-2.8863	0.0203	-1.40E+04	-1.57E+03
	Nassarawa	-8.73E+03	33396.04	-2.571	0.0331	-1.66E+04	-900.0979
	Difference	921.8	0.2123	0.8372	0.8372	-9.09E+03	1.09E+04
tpos_nat_f20_24	Abuja	-116.5	33.2919	-3.4994	0.0081	-193.2712	-39.7288
	Nasarawa	-118.5	95.1579	-1.2453	0.2483	-337.9346	100.9346
	Difference	2	100.8136	0.0198	0.9847	-230.4766	234.4766
ttested_nat_m15_19	Akwa-Ibom	-2.68E+03	399.6	-6.6959	0.0002	-3.60e	-1.75e
	Rivers	1824.8	2483.82	0.7347	0.4835	-3.90e	7552.522
	Difference	-4.50E+03	2515.76	-1.7889	0.1114	-1.03e	1300.8742
tpos_nat_m15_19	Akwa-Ibom	-2.2	19.9427	-0.1103	0.9149	-48.188	43.788
	Rivers	-33.1	14.7735	-2.2405	0.0554	-67.1678	0.9678
	Difference	30.9	24.8187	1.245	0.2484	-26.3321	88.1321
ttested_nat_f15_19.	Akwa-Ibom	2523.2	2337.33	1.0795	0.3118	-2.87E+03	7913.09
	Rivers	-1.05E+03	31544.21	-0.6831	0.5139	-4.62E+03	2506.1665
	Difference	3578	2801.37	1.2772	0.2373	-2.88E+03	1.00E+04
tpos_nat_f15_19	Akwa-Ibom	48.4	35.1839	1.3756	0.2062	-32.73	129.53
	Rivers	-36.6	28.9714	-1.2633	0.242	-30.4	30.2
	Difference	85	45.5768	1.865	0.0992	-20.1	190.1
ttested_nat_m20_24	Akwa-Ibom	1966.1	1298.4397	1.5142	0.1684	-1.03E+03	4960.3

	Rivers	-2.55E+03	1484.28	-1.7206	0.1236	-5.98E+03	868.972
	Difference	4519.9	1972.0684	2.292	0.0511	-27.69	9067.49
tpos_nat_m20_24.	Akwa-Ibom	-58.4	81.7951	-0.714	0.4955	-247.0199	130.21
	Rivers	-79.7	32.7852	-2.431	0.0411	-155.3027	-4.0973
	Difference	21.3	88.121	0.2417	0.8151	-181.9074	224.5
ttested_nat_f20_24	Akwa-Ibom	3502.1	5852.8	0.5984	0.5661	-9.99E+03	1.70E+04
	Rivers	-3.37E+03	34822.9	-0.6989	0.5044	-1.45E+04	7750.84
	Difference	6873.1	7583.96	0.9063	0.3913	-1.06E+04	2.44E+04
tpos_nat_f20_24	Akwa-Ibom	473.1	58.5006	8.0871	0	338.1974	608
	Rivers	-129.3	152.3655	-0.8486	0.4208	-480.6556	222.05
	Difference	602.4	163.2102	3.6909	0.0061	226.0365	978.78
ttested_nat_m15_19	Oyo	-5.95E+03	32101.5	-2.8295	0.0222	-11900	-1.10E+03
	Lagos	-3.14E+03	31563.04	-2.0097	0.0793	-6.75E+03	463.09
	Difference	-2.81E+03	32619	-1.071	0.3154	-8.84E+03	3234.54
tpos_nat_m15_19	Oyo	-15.3	2.8317	-5.403	0.0006	-21.83	-8.77
	Lagos	-39.3	17.6439	-2.2274	0.0565	-79.9869	1.3869
	Difference	24	17.8697	1.3431	0.2161	-17.2076	65.2076
ttested_nat_f15_19	Oyo	-9.05E+03	3752.6197	-2.4116	0.0424	-1.77E+04	-396.24
	Lagos	-5.06E+03	32739.96	-1.8455	0.1022	-1.14E+04	1261.8764
	Difference	-3.99E+03	34646.45	-0.8594	0.4151	-1.47E+04	6721.45
tpos_nat_f15_19	Oyo	-11.7	13.9832	-0.8367	0.427	-43.9454	20.5454
	Lagos	-16.3	21.3806	-0.7624	0.4677	-65.6038	33.0038
	Difference	4.6	25.5472	0.1801	0.8616	-54.312	63.512
ttested_nat_m20_24	Oyo	-9.59E+03	32613.74	-3.6697	0.0063	-1.56E+04	-3.56E+03
	Lagos	-6.89E+03	32357.31	-2.9249	0.0191	-1.23E+04	-1.46E+03
	Difference	-2.70E+03	33519.74	-0.7662	0.4656	-1.08E+04	5419.7401
tpos_nat_m20_24.	Oyo	-43.3	20.7766	-2.0841	0.0707	-91.2109	4.6109
	Lagos	-75.5	64.8209	-1.1647	0.2777	-224.9773	73.97
	Difference	32.2	68.0692	0.473	0.6488	-124.7679	189.16
ttested_nat_f20_24	Oyo	-1.98E+04	44832.99	-4.089	0.0035	-3.09E+04	-8.62E+03
	Lagos	-1.35E+04	47185.55	-1.8771	0.0973	-3.01E+04	3081.95
	Difference	-6.27E+03	38659.68	-0.7245	0.4894	-2.62E+04	1.37E+04
tpos_nat_f20_24	Oyo	-47.4	55.3205	-0.8568	0.4165	-174.96	80.16
	Lagos	-135.2	54.3746	-2.4865	0.0377	-260.58	-9.81
	Difference	87.8	77.569	1.1319	0.2905	-91.07	266.67

Annex F- Mean and median testing and positivity yield of HMIS and project data in Abuja, Akwa-Ibom, Lagos, Nasarawa, Oyo and Rivers.

Half yearly state summary data																	
		ttested_nat_m15_19		tpos_nat_m15_19		ttested_nat_f15_19		tpos_nat_f15_19		ttested_nat_m20_24		tpos_nat_m20_24		ttested_nat_f20_24		tpos_nat_f20_24	
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Abuja	Before intervention	28475	26333	90	75	33183	30234	182	146	48920	46000	252	199	59770.50	53381.50	889	688
	After intervention	5574	4865	30	28	10186	10362	103	101	10480	9239	104	105	30330.50	28395.50	465	450
Akwa-Ibom	Before intervention	31683	33984	237	159	29182	25013	652	655	36261	29621	663	630	55502.75	45657.50	2255	2111
	After intervention	6097	6634	71	65	16012	14133	360	359	15697	14061	227	275	18138.25	20782.50	1551	1481
Lagos	Before intervention	14643	13425	95	88	21380	20567	98	101	31067	28297	225	209	49412.25	49037.50	474	498
	After intervention	12335	11073	90	71	19596	16472	127	115	23441	20186	337	338	46176.14	36390.50	461	397
Nassarawa	Before intervention	7352	5537	62	51	10615	9000	168	151	9152	7511	174	157	17596.75	17545.50	577	598
	After intervention	6550	5513	51	34	13285	10644	104	78	8946	7039	110	82	23201.50	19248.00	315	241
Oyo	Before intervention	70390	21451	54	48	29426	29331	74	73	20586	15667	120	96	47706.75	46178.00	331	277
	After intervention	16920	15500	43	39	22851	17032	91	94	22241	18510	64	33	42637.00	35250.50	200	165
River	Before intervention	5289	4671	56	52	8268	8380	103	94	10775	9997	221	215	19880.75	20034.00	541	548
	After intervention	5750	4285	47	26	9271	10973	107	78	7149	5811	112	66	20864.00	19676.50	540	433
Half yearly prog summary data																	
		ttested_prog_m15_19		tpos_prog_m15_19		ttested_prog_f15_19		tpos_prog_f15_19		ttested_prog_m20_24		tpos_prog_m20_24		ttested_prog_f20_24		tpos_prog_f20_24	
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Abuja	Before intervention	605	600	2	1	872	579	3	3	2421	2415	4	5	1926	1768	24	20
	After intervention	72	73	2	2	1207	1249	11	8	421	423	2	1	2562	2768	107	116
Akwa-Ibom	Before intervention	1106	1119	3	3	1675	1590	10	10	3694	3733	17	17	3906	4004	48	51
	After intervention	953	903	7	6	5167	6090	81	108	3379	3657	28	31	12754	13815	501	462

Oyo	Before intervention	499	471	0	0	1037	904	2	1	2252	2263	3	3	2913	2625	10	9
	After intervention	334	326	1	1	1217	1602	12	11	1526	1512	8	9	3365	4802	88	97
Monthly prog summary data																	
		No. tested m15_19		No. positive m15_19		No. tested f15_19		No. positive f15_19		No. tested m20_24		No. positive m20_24		No. tested f20_24		No. positive f20_24	
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Abuja	Before Intervention	93	77	0	0	145	82	1	0	376	320	1	0	321	332	4	4
	After Intervention	14	11	0	0	241	217	2	2	78	66	0	0	512	476	21	24
Akwa-Ibom	Before Intervention	181	185	1	0	279	235	2	1	605	601	3	3	651	581	8	7
	After Intervention	173	170	1	1	1033	1030	16	16	612	661	5	5	2551	2514	100	86
Oyo	Before Intervention	80	96	0	0	173	128	0	0	363	340	0	0	485	379	2	1
	After Intervention	61	54	0	0	243	267	2	1	277	283	2	1	673	634	18	13

Table G: Regression of Linear trend of HTS uptake and positivity yield at the Project level by state.

States	Age categories	Coef.	Newey-West Std. Err.	t	P>t	[95% Conf. Interval]		
	ttested_prog_m15_19							
Abuja	_t	-1.227258	2.097118	-0.59	0.562	-5.476422	3.021906	Number of obs = 41; F(3, 37) = 10.53; Prob > F = 0.0000
	_x699	-62.77673	38.03443	-1.65	0.107	-139.8418	14.28835	
	_x_t699	1.380829	2.160849	0.64	0.527	-2.997466	5.759124	
	_cons	108.7044	26.07458	4.17	0	55.87224	161.5365	
Akwa-Ibom	_t	-2.665064	1.427016	-1.87	0.07	-5.556473	0.2263441	Number of obs = 41; F(3, 37) = 1.72; Prob > F = 0.1805
	_x699	60.11343	38.351	1.57	0.126	-17.59308	137.8199	
	_x_t699	-1.559936	4.114541	-0.38	0.707	-9.896788	6.776917	
	_cons	214.0183	16.54246	12.94	0	180.5001	247.5365	
Oyo	_t	-1.838687	0.7210344	-2.55	0.015	-3.299641	-0.3777323	Number of obs = 41; F(3, 37) = 4.45; Prob > F = 0.0091
	_x699	11.10414	18.19958	0.61	0.546	-25.77171	47.97998	
	_x_t699	1.310115	1.612406	0.81	0.422	-1.95693	4.577161	
	_cons	103.2404	10.73162	9.62	0	81.49608	124.9847	
	tpos_prog_m15_19							
Abuja	_t	-0.020803	0.0162639	-1.28	0.209	-0.053757	0.0121507	Number of obs = 41; F(3, 37) = 2.44; Prob > F = 0.0793
	_x699	0.685943	0.3068437	2.24	0.032	0.064218	1.307667	
	_x_t699	-0.000625	0.0337513	-0.02	0.985	-0.069012	0.0677612	
	_cons	0.492409	0.3036126	1.62	0.113	-0.122769	1.107586	
Akwa-Ibom	_t	-0.0162	0.021096	-0.77	0.447	-0.058945	0.0265445	Number of obs = 41; F(3, 37) = 3.14; Prob > F = 0.0365
	_x699	0.041987	0.4876465	0.09	0.932	-0.946079	1.030053	
	_x_t699	0.162629	0.0774756	2.1	0.043	0.005648	0.319609	
	_cons	0.703746	0.3897342	1.81	0.079	-0.08593	1.493423	
Oyo	_t	-0.007655	0.0073471	-1.04	0.304	-0.022542	0.0072317	

	_x699	0.238613	0.2057435	1.16	0.254	-0.178263	0.6554889	Number of obs = 41; F(3, 37) = 1.37; Prob > F = 0.2682
	_x_t699	0.021941	0.0232856	0.94	0.352	-0.02524	0.0691218	
	_cons	0.134737	0.1292162	1.04	0.304	-0.12708	0.3965541	
	ttested_prog_f15_19							
Abuja	_t	10.96783	4.274281	2.57	0.015	2.290573	19.64508	Number of obs = 39; F(3, 35) = 7.35; Prob > F = 0.0006
	_x699	-93.6013	111.2711	-0.84	0.406	-319.4937	132.2911	
	_x_t699	-8.167826	8.50144	-0.96	0.343	-25.42667	9.091014	
	_cons	19.20333	35.88257	0.54	0.596	-53.64216	92.04882	
Akwa-Ibom	_t	2.225652	5.845313	0.38	0.706	-9.640964	14.09227	Number of obs = 39; F(3, 35) = 14.15; Prob > F = 0.0000
	_x699	734.3274	346.952	2.12	0.041	29.97734	1438.677	
	_x_t699	-4.325652	35.31295	-0.12	0.903	-76.01474	67.36344	
	_cons	253.6133	55.30772	4.59	0	141.3327	365.894	
Oyo	_t	5.62	3.89193	1.44	0.158	-2.281038	13.52104	Number of obs = 39; F(3, 35) = 2.16; Prob > F = 0.1100
	_x699	-101.8017	101.8142	-1	0.324	-308.4955	104.8921	
	_x_t699	6.562143	10.85231	0.6	0.549	-15.46922	28.59351	
	_cons	108.12	39.76271	2.72	0.01	27.3974	188.8426	
	tpos_prog_f15_19							
Abuja	_t	0.013913	0.0204129	0.68	0.5	-0.027527	0.0553535	Number of obs = 39; F(3, 35) = 6.98; Prob > F = 0.0008
	_x699	2.167681	0.846194	2.56	0.015	0.449816	3.885546	
	_x_t699	-0.121056	0.0888376	-1.36	0.182	-0.301406	0.059294	
	_cons	0.34	0.2227561	1.53	0.136	-0.112219	0.792219	
Akwa-Ibom	_t	-0.035217	0.0529748	-0.66	0.511	-0.142762	0.0723272	Number of obs = 39; F(3, 35) = 20.61; Prob > F = 0.0000
	_x699	4.57087	3.068609	1.49	0.145	-1.658739	10.80048	
	_x_t699	1.520932	0.4410896	3.45	0.001	0.625472	2.416391	
	_cons	2.113333	0.8395656	2.52	0.017	0.408925	3.817742	
Oyo	_t	0.025217	0.0150565	1.67	0.103	-0.005349	0.0557837	Number of obs = 39; F(3, 35) = 4.51; Prob > F = 0.0089
	_x699	1.93413	1.317589	1.47	0.151	-0.740718	4.608979	
	_x_t699	-0.050217	0.1350449	-0.37	0.712	-0.324373	0.2239383	
	_cons	-0.04	0.1140101	-0.35	0.728	-0.271453	0.1914529	

	ttested_prog_m20_24							
Abuja	_t	-9.826429	6.224028	-1.58	0.123	-22.43751	2.784649	Number of obs = 41; F(3, 37) = 12.68; Prob > F = 0.0000
	_x699	-162.3118	103.2152	-1.57	0.124	-371.4457	46.82219	
	_x_t699	10.79429	6.802312	1.59	0.121	-2.988508	24.57708	
	_cons	499.317	92.78773	5.38	0	311.3112	687.3228	
Akwa-Ibom	_t	-2.668065	4.778489	-0.56	0.58	-12.3502	7.014073	Number of obs = 41; F(3, 37) = 0.12; Prob > F = 0.9501
	_x699	57.14582	129.853	0.44	0.662	-205.9614	320.2531	
	_x_t699	0.925208	12.46844	0.07	0.941	-24.33825	26.18867	
	_cons	638.8253	45.80996	13.95	0	546.0055	731.6451	
Oyo	_t	-0.043437	3.376625	-0.01	0.99	-6.88513	6.798255	Number of obs = 41; F(3, 37) = 4.44; Prob > F = 0.0092
	_x699	-33.11132	75.86436	-0.44	0.665	-186.8271	120.6045	
	_x_t699	-7.438706	4.573547	-1.63	0.112	-16.70559	1.828181	
	_cons	363.3925	42.67572	8.52	0	276.9232	449.8617	
	tpos_prog_m20_24							
Abuja	_t	-0.011775	0.0193989	-0.61	0.548	-0.051081	0.0275311	Number of obs = 41; F(3, 37) = 0.97; Prob > F = 0.4162
	_x699	-0.000683	0.393429	0	0.999	-0.797846	0.7964801	
	_x_t699	-0.009654	0.0327567	-0.29	0.77	-0.076025	0.0567177	
	_cons	0.801938	0.356376	2.25	0.03	0.079852	1.524024	
Akwa-Ibom	_t	0.041479	0.0410923	1.01	0.319	-0.041782	0.1247401	Number of obs = 41; F(3, 37) = 2.70; Prob > F = 0.0596
	_x699	0.608795	1.370671	0.44	0.66	-2.168449	3.386039	
	_x_t699	0.097807	0.1780352	0.55	0.586	-0.262927	0.4585402	
	_cons	2.362936	0.5599378	4.22	0	1.228394	3.497478	
Oyo	_t	-0.004858	0.01478	-0.33	0.744	-0.034805	0.0250898	Number of obs = 41; F(3, 37) = 5.76; Prob > F = 0.0024
	_x699	2.813649	0.690688	4.07	0	1.414182	4.213116	
	_x_t699	-0.209428	0.0616875	-3.39	0.002	-0.334419	-0.0844374	
	_cons	0.484169	0.2520829	1.92	0.063	-0.0266	0.9949372	
	ttested_prog_f20_24							
Abuja	_t	7.2	5.039801	1.43	0.162	-3.03134	17.43134	Number of obs = 39; F(3, 35) =
	_x699	86.225	109.445	0.79	0.436	-135.9601	308.4101	

	_x_t699	-8.096429	9.264297	-0.87	0.388	-26.90395	10.7111	5.73; Prob > F = 0.0027
	_cons	238.1167	66.64817	3.57	0.001	102.8137	373.4196	
Akwa-Ibom	_t	7.386087	9.617361	0.77	0.448	-12.13819	26.91037	Number of obs = 39; F(3, 35) = 19.94; Prob > F = 0.0000
	_x699	457.1157	445.9092	1.03	0.312	-448.1281	1362.359	
	_x_t699	182.3568	63.90559	2.85	0.007	52.62153	312.092	
	_cons	566.06	77.03518	7.35	0	409.6703	722.4497	
Oyo	_t	13.67261	6.328219	2.16	0.038	0.825641	26.51958	Number of obs = 39; F(3, 35) = 3.37; Prob > F = 0.0293
	_x699	-376.3921	207.9682	-1.81	0.079	-798.5901	45.80589	
	_x_t699	36.62382	29.8948	1.23	0.229	-24.06585	97.31349	
	_cons	328.2233	57.04504	5.75	0	212.4157	444.0309	
	tpos_prog_f20_24							
Abuja	_t	0.162609	0.0849719	1.91	0.064	-0.009894	0.3351109	Number of obs = 39; F(3, 35) = 18.85; Prob > F = 0.0000
	_x699	11.10457	3.912355	2.84	0.007	3.162063	19.04707	
	_x_t699	0.398106	0.38128	1.04	0.304	-0.375934	1.172145	
	_cons	2.046667	0.8896028	2.3	0.027	0.240677	3.852656	
Akwa-Ibom	_t	-0.086087	0.1317005	-0.65	0.518	-0.353453	0.1812793	Number of obs = 39; F(3, 35) = 57.36; Prob > F = 0.0000
	_x699	-1.098986	14.22216	-0.08	0.939	-29.97151	27.77354	
	_x_t699	13.60752	3.436832	3.96	0	6.630375	20.58466	
	_cons	8.906667	1.795089	4.96	0	5.262442	12.55089	
Oyo	_t	0.018261	0.0447055	0.41	0.685	-0.072496	0.1090178	Number of obs = 39; F(3, 35) = 9.41; Prob > F = 0.0001
	_x699	2.141957	4.768973	0.45	0.656	-7.539573	11.82349	
	_x_t699	1.913882	1.064739	1.8	0.081	-0.247654	4.075418	
	_cons	1.373333	0.7332928	1.87	0.069	-0.11533	2.861997	

Table H: Regression of HTS uptake and positivity yield at the HMIS Level by intervention states compared to control states 2016-2019.

			Newey-West				
		Coef.	Std. Err.	t	P>t	[95% Confidence Interval	
	Abuja/Nassarawa						
ttested_nat_m15_19	_t	-1085.6	2158.953	-0.5	0.629	-6064.154	3892.954
	_z	41991	14487.95	2.9	0.02	8581.736	75400.26
	_z_t	-13911.5	5297.979	-2.63	0.03	-26128.66	-1694.339
	_x116	8261.7	4853.775	1.7	0.127	-2931.125	19454.52
	_x_t116	-3147.2	2300.729	-1.37	0.209	-8452.691	2158.291
	_z_x116	10125.8	13340.52	0.76	0.47	-20637.49	40889.09
	_z_x_t116	15613.8	5378.086	2.9	0.02	3211.912	28015.69
	_cons	8979.9	6150.093	1.46	0.182	-5202.239	23162.04
tpos_nat_m15_19	_t	-12.9	10.78968	-1.2	0.266	-37.78105	11.98105
	_z	72.6	62.45632	1.16	0.279	-71.42453	216.6245
	_z_t	-29.9	22.04182	-1.36	0.212	-80.72854	20.92854
	_x116	67.2	40.96424	1.64	0.14	-27.2637	161.6637
	_x_t116	-17.9	17.15488	-1.04	0.327	-57.45923	21.65923
	_z_x116	-6.3	57.44679	-0.11	0.915	-138.7725	126.1725
	_z_x_t116	51.6	25.78674	2	0.08	-7.864331	111.0643
	_cons	81.1	30.38192	2.67	0.028	11.03916	151.1608
ttested_nat_f15_19	_t	-716.2	2718.428	-0.26	0.799	-6984.907	5552.507
	_z	42720	16770.7	2.55	0.034	4046.692	81393.31
	_z_t	-13434.5	6063.3	-2.22	0.058	-27416.49	547.4938
	_x116	10693.4	8052.112	1.33	0.221	-7874.804	29261.6
	_x_t116	-3439.4	3625.282	-0.95	0.371	-11799.32	4920.515
	_z_x116	10501.3	15381.26	0.68	0.514	-24967.95	45970.55

	_z_x_t116	11713.3	6521.95	1.8	0.11	-3326.345	26752.94
	_cons	11689.3	7565.214	1.55	0.161	-5756.116	29134.72
tpos_nat_f15_19	_t	-47.9	36.74367	-1.3	0.229	-132.6311	36.83105
	_z	16.6	149.0498	0.11	0.914	-327.1096	360.3096
	_z_t	-1.4	53.3565	-0.03	0.98	-124.4403	121.6403
	_x116	120.8	123.2008	0.98	0.356	-163.3016	404.9016
	_x_t116	4.7	48.40452	0.1	0.925	-106.921	116.321
	_z_x116	-23.7	143.3124	-0.17	0.873	-354.1791	306.7791
	_z_x_t116	9.2	62.07673	0.15	0.886	-133.9492	152.3492
	_cons	239.6	100.1444	2.39	0.044	8.666711	470.5333
ttested_nat_m20_24	_t	-1287.6	2313.862	-0.56	0.593	-6623.375	4048.175
	_z	71143.8	21711.24	3.28	0.011	21077.59	121210
	_z_t	-20917.2	8082.32	-2.59	0.032	-39555.06	-2279.337
	_x116	10652.5	6297.489	1.69	0.129	-3869.535	25174.54
	_x_t116	-3805.4	2708.513	-1.4	0.198	-10051.24	2440.441
	_z_x116	15827.8	21617.22	0.73	0.485	-34021.61	65677.21
	_z_x_t116	19738	8263.67	2.39	0.044	681.9427	38794.06
	_cons	11082.9	6529.864	1.7	0.128	-3974.992	26140.79
tpos_nat_m20_24	_t	-32.5	24.60142	-1.32	0.223	-89.23098	24.23098
	_z	145.7	175.6666	0.83	0.431	-259.388	550.788
	_z_t	-45.3	61.99944	-0.73	0.486	-188.271	97.67097
	_x116	113.9	81.43884	1.4	0.199	-73.89831	301.6983
	_x_t116	-31.6	34.92207	-0.9	0.392	-112.1304	48.93045
	_z_x116	7	135.7092	0.05	0.96	-305.9461	319.9461
	_z_x_t116	59.8	66.82493	0.89	0.397	-94.29856	213.8986

	_cons	222.5	66.94572	3.32	0.01	68.12288	376.8771
ttested_nat_f20_24	_t	514.5	3823.393	0.13	0.896	-8302.26	9331.26
	_z	71213.6	27383.77	2.6	0.032	8066.505	134360.7
	_z_t	-19359.9	9917.181	-1.95	0.087	-42228.96	3509.16
	_x116	17415.6	13311.28	1.31	0.227	-13280.26	48111.46
	_x_t116	-9245.9	5113.852	-1.81	0.108	-21038.46	2546.663
	_z_x116	11972.3	24429.76	0.49	0.637	-44362.82	68307.42
	_z_x_t116	20281.7	10826.11	1.87	0.098	-4683.364	45246.76
	_cons	16825	9191.21	1.83	0.105	-4369.967	38019.97
tpos_nat_f20_24	_t	-185.3	102.6235	-1.81	0.109	-421.9503	51.35026
	_z	395.9	578.4825	0.68	0.513	-938.083	1729.883
	_z_t	-56.1	214.029	-0.26	0.8	-549.6517	437.4517
	_x116	378.5	416.8815	0.91	0.39	-582.8305	1339.831
	_x_t116	66.8	139.9522	0.48	0.646	-255.9303	389.5303
	_z_x116	-24	534.1362	-0.04	0.965	-1255.72	1207.72
	_z_x_t116	58.1	236.5835	0.25	0.812	-487.4626	603.6626
	_cons	855.2	225.657	3.79	0.005	334.834	1375.566
	Akwa-Ibom/Rivers						
ttested_nat_m15_19	_t	-1106.3	576.8532 -1.92	0.091		2436.526	223.9259
	_z	19182.9	8360.145 2.29	0.051		95.62876	38461.43
	_z_t	4807.4	7642.579 0.63	0.547		12816.42	22431.22
	_x116	489.3	4215.462 0.12	0.91		9231.574	10210.17
	_x_t116	2931.1	2549.935 1.15	0.284		2949.062	8811.262
	_z_x116	-31314.5	28878.51 -1.08	0.31		97908.45	35279.45
	_z_x_t116	-9307.9	8045.999 -1.16	0.281		27862.01	9246.207
	_cons	6948.2	1631.58 4.26	0.003		3185.769	10710.63

tpos_nat_m15_19	_t	17.1	5.826937	2.93	0.019	3.663058	30.53694
	_z	410.7	105.0211	3.91	0.004	168.5209	652.8791
	_z_t	-152.8	51.60973	-2.96	0.018	-271.8122	-33.78775
	_x116	-1.6	38.40301	-0.04	0.968	-90.1575	86.9575
	_x_t116	-50.2	15.88113	-3.16	0.013	-86.82196	-13.57804
	_z_x116	177.9	143.1968	1.24	0.249	-152.3125	508.1125
	_z_x_t116	183.7	57.26722	3.21	0.012	51.64156	315.7584
	_cons	30.1	13.92685	2.16	0.063	-2.015378	62.21538
ttested_nat_f15_19.	_t	-722.1	811.4798	-0.89	0.4	-2593.376	1149.176
	_z	36672.3	15011.13	2.44	0.04	2056.57	71288.03
	_z_t	-10505.7	5261.622	-2	0.081	-22639.02	1627.621
	_x116	4390.2	2344.631	1.87	0.098	-1016.528	9796.928
	_x_t116	-332.7	1744.448	-0.19	0.853	-4355.405	3690.005
	_z_x116	6724.5	10613.67	0.63	0.544	-17750.66	31199.66
	_z_x_t116	14083.7	5960.904	2.36	0.046	337.8297	27829.57
	_cons	9350.9	2302.858	4.06	0.004	4040.5	14661.3
tpos_nat_f15_19	_t	3.2	8.105109	0.39	0.703	-15.49042	21.89042
	_z	874.8	93.45153	9.36	0	659.3004	1090.3
	_z_t	-217.2	49.55091	-4.38	0.002	-331.4646	-102.9354
	_x116	50.4	72.62343	0.69	0.507	-117.0699	217.8699
	_x_t116	-39.8	30.08375	-1.32	0.222	-109.1733	29.57325
	_z_x116	120	194.4448	0.62	0.554	-328.3905	568.3905
	_z_x_t116	302.2	67.32414	4.49	0.002	146.9503	457.4497
	_cons	98.2	9.142691	10.74	0	77.11692	119.2831

ttested_nat_m20_24	_t	-2326.7	863.554	-2.69	0.027	-4318.059	-335.3408
	_z	47208.1	22060.93	2.14	0.065	-3664.504	98080.7
	_z_t	-14481.4	7737.784	-1.87	0.098	-32324.76	3361.961
	_x116	6021.2	3282.932	1.83	0.104	-1549.254	13591.65
	_x_t116	-227.1	1717.217	-0.13	0.898	-4187.009	3732.809
	_z_x116	12485.9	15738.07	0.79	0.45	-23806.15	48777.95
	_z_x_t116	19001.3	7985.133	2.38	0.045	587.5502	37415.05
	_cons	14265.3	2464.087	5.79	0	8583.105	19947.49
tpos_nat_m20_24.	_t	51.2	16.75556	3.06	0.016	12.56161	89.83839
	_z	974.3	92.03073	10.59	0	762.0768	1186.523
	_z_t	-354.7	66.97297	-5.3	0.001	-509.1399	-200.2601
	_x116	-117.7	89.78609	-1.31	0.226	-324.7471	89.34711
	_x_t116	-130.9	36.81869	-3.56	0.007	-215.804	-45.99596
	_z_x116	527.8	294.6118	1.79	0.111	-151.576	1207.176
	_z_x_t116	376	110.6828	3.4	0.009	120.7649	631.2351
	_cons	144.2	44.13304	3.27	0.011	42.42904	245.971
ttested_nat_f20_24	_t	739.1	1641.923	0.45	0.665	-3047.18	4525.38
	_z	61138.2	29612.9	2.06	0.073	-7149.263	129425.7
	_z_t	-17010.8	10467.73	-1.63	0.143	-41149.42	7127.821
	_x116	4192	9954.777	0.42	0.685	-18763.76	27147.76
	_x_t116	-4110.1	5094.818	-0.81	0.443	-15858.77	7638.571
	_z_x116	-6130.4	24173.24	-0.25	0.806	-61873.98	49613.18
	_z_x_t116	23883.9	12926.33	1.85	0.102	-5924.261	53692.06
	_cons	18772.1	4058.499	4.63	0.002	9413.186	28131.01
tpos_nat_f20_24	_t	60.5	16.15023	3.75	0.006	23.2575	97.7425
	_z	2858.8	843.1415	3.39	0.009	914.5121	4803.088

	_z_t	-763.2	309.5222	-2.47	0.039	-1476.959	-49.44052
	_x116	41.2	319.0423	0.13	0.9	-694.5128	776.9128
	_x_t116	-189.8	153.2191	-1.24	0.251	-543.1238	163.5238
	_z_x116	301.9	845.4588	0.36	0.73	-1647.731	2251.531
	_z_x_t116	1365.6	349.9165	3.9	0.005	558.6911	2172.509
	_cons	450.5	43.8421	10.28	0	349.3999	551.6001

			Newey-West				
		Coef.	**Std. Err.**	**t**	**P>t**	**[95% Confidence Interval**	
	Akwa-Ibom/Rivers						
ttested_nat_m15_19	_t	-1106.3	576.8532	-1.92	0.091	2436.526	223.9259
	_z	19182.9	8360.145	2.29	0.051	95.62876	38461.43
	_z_t	4807.4	7642.579	0.63	0.547	12816.42	22431.22
	_x116	489.3	4215.462	0.12	0.91	9231.574	10210.17
	_x_t116	2931.1	2549.935	1.15	0.284	2949.062	8811.262
	_z_x116	-31314.5	28878.51	-1.08	0.31	97908.45	35279.45
	_z_x_t116	-9307.9	8045.999	-1.16	0.281	27862.01	9246.207
	_cons	6948.2	1631.58	4.26	0.003	3185.769	10710.63
tpos_nat_m15_19	_t	17.1	5.826937	2.93	0.019	3.663058	30.53694
	_z	410.7	105.0211	3.91	0.004	168.5209	652.8791
	_z_t	-152.8	51.60973	-2.96	0.018	-271.8122	-33.78775
	_x116	-1.6	38.40301	-0.04	0.968	-90.1575	86.9575
	_x_t116	-50.2	15.88113	-3.16	0.013	-86.82196	-13.57804
	_z_x116	177.9	143.1968	1.24	0.249	-152.3125	508.1125
	_z_x_t116	183.7	57.26722	3.21	0.012	51.64156	315.7584

	_cons	30.1	13.92685	2.16	0.063	-2.015378	62.21538
ttested_nat_f15_19.	_t	-722.1	811.4798	-0.89	0.4	-2593.376	1149.176
	_z	36672.3	15011.13	2.44	0.04	2056.57	71288.03
	_z_t	-10505.7	5261.622	-2	0.081	-22639.02	1627.621
	_x116	4390.2	2344.631	1.87	0.098	-1016.528	9796.928
	_x_t116	-332.7	1744.448	-0.19	0.853	-4355.405	3690.005
	_z_x116	6724.5	10613.67	0.63	0.544	-17750.66	31199.66
	_z_x_t116	14083.7	5960.904	2.36	0.046	337.8297	27829.57
	_cons	9350.9	2302.858	4.06	0.004	4040.5	14661.3
tpos_nat_f15_19	_t	3.2	8.105109	0.39	0.703	-15.49042	21.89042
	_z	874.8	93.45153	9.36	0	659.3004	1090.3
	_z_t	-217.2	49.55091	-4.38	0.002	-331.4646	-102.9354
	_x116	50.4	72.62343	0.69	0.507	-117.0699	217.8699
	_x_t116	-39.8	30.08375	-1.32	0.222	-109.1733	29.57325
	_z_x116	120	194.4448	0.62	0.554	-328.3905	568.3905
	_z_x_t116	302.2	67.32414	4.49	0.002	146.9503	457.4497
	_cons	98.2	9.142691	10.74	0	77.11692	119.2831
ttested_nat_m20_24	_t	-2326.7	863.554	-2.69	0.027	-4318.059	-335.3408
	_z	47208.1	22060.93	2.14	0.065	-3664.504	98080.7
	_z_t	-14481.4	7737.784	-1.87	0.098	-32324.76	3361.961
	_x116	6021.2	3282.932	1.83	0.104	-1549.254	13591.65
	_x_t116	-227.1	1717.217	-0.13	0.898	-4187.009	3732.809
	_z_x116	12485.9	15738.07	0.79	0.45	-23806.15	48777.95
	_z_x_t116	19001.3	7985.133	2.38	0.045	587.5502	37415.05
	_cons	14265.3	2464.087	5.79	0	8583.105	19947.49

tpos_nat_m20_24.	_t	51.2	16.75556	3.06	0.016	12.56161	89.83839
	_z	974.3	92.03073	10.59	0	762.0768	1186.523
	_z_t	-354.7	66.97297	-5.3	0.001	-509.1399	-200.2601
	_x116	-117.7	89.78609	-1.31	0.226	-324.7471	89.34711
	_x_t116	-130.9	36.81869	-3.56	0.007	-215.804	-45.99596
	_z_x116	527.8	294.6118	1.79	0.111	-151.576	1207.176
	_z_x_t116	376	110.6828	3.4	0.009	120.7649	631.2351
	_cons	144.2	44.13304	3.27	0.011	42.42904	245.971
ttested_nat_f20_24	_t	739.1	1641.923	0.45	0.665	-3047.18	4525.38
	_z	61138.2	29612.9	2.06	0.073	-7149.263	129425.7
	_z_t	-17010.8	10467.73	-1.63	0.143	-41149.42	7127.821
	_x116	4192	9954.777	0.42	0.685	-18763.76	27147.76
	_x_t116	-4110.1	5094.818	-0.81	0.443	-15858.77	7638.571
	_z_x116	-6130.4	24173.24	-0.25	0.806	-61873.98	49613.18
	_z_x_t116	23883.9	12926.33	1.85	0.102	-5924.261	53692.06
	_cons	18772.1	4058.499	4.63	0.002	9413.186	28131.01
tpos_nat_f20_24	_t	60.5	16.15023	3.75	0.006	23.2575	97.7425
	_z	2858.8	843.1415	3.39	0.009	914.5121	4803.088
	_z_t	-763.2	309.5222	-2.47	0.039	-1476.959	-49.44052
	_x116	41.2	319.0423	0.13	0.9	-694.5128	776.9128
	_x_t116	-189.8	153.2191	-1.24	0.251	-543.1238	163.5238
	_z_x116	301.9	845.4588	0.36	0.73	-1647.731	2251.531
	_z_x_t116	1365.6	349.9165	3.9	0.005	558.6911	2172.509
	_cons	450.5	43.8421	10.28	0	349.3999	551.6001

			Newey-West				
		Coef.	Std. Err.	t	P>t	[95% Confidence Interval	
	Oyo/Lagos						
ttested_nat_m15_19	_t	-2433.3	813.212	-2.99	0.017	-4308.57	-558.0298
	_z	151459.4	73155.13	2.07	0.072	-17236.62	320155.4
	_z_t	-63808.6	32943.82	-1.94	0.089	-139777.2	12159.98
	_x116	8487.2	3177.014	2.67	0.028	1160.993	15813.41
	_x_t116	-708	1761.94	-0.4	0.698	-4771.041	3355.041
	_z_x116	112567	76375.87	1.47	0.179	-63556.07	288690.1
	_z_x_t116	61003.6	33047.76	1.85	0.102	-15204.67	137211.9
	_cons	18293.2	1951.766	9.37	0	13792.42	22793.98
tpos_nat_m15_19	_t	-9.4	27.53745	-0.34	0.742	-72.90148	54.10148
	_z	-37.6	59.19371	-0.64	0.543	-174.1009	98.90094
	_z_t	-2.6	28.9429	-0.09	0.931	-69.34244	64.14244
	_x116	77.2	88.43084	0.87	0.408	-126.7219	281.1219
	_x_t116	-29.9	32.70501	-0.91	0.387	-105.3179	45.5179
	_z_x116	-35	90.90466	-0.39	0.71	-244.6265	174.6265
	_z_x_t116	26.6	34.01495	0.78	0.457	-51.83861	105.0386
	_cons	109.1	53.63269	2.03	0.076	-14.5772	232.7772
ttested_nat_f15_19	_t	-2039.4	546.2754	-3.73	0.006	-3299.113	-779.6867
	_z	20343.2	3660.266	5.56	0.001	11902.61	28783.79
	_z_t	-8197.8	2827.533	-2.9	0.02	-14718.1	-1677.497
	_x116	10900	5683.594	1.92	0.091	-2206.392	24006.39
	_x_t116	-3017.1	2793.893	-1.08	0.312	-9459.829	3425.629
	_z_x116	21692.7	14526.84	1.49	0.174	-11806.25	55191.65

	_z_x_t116	4204.5	5439.165	0.77	0.462	-8338.238	16747.24
	_cons	24438.6	1325.279	18.44	0	21382.5	27494.7
tpos_nat_f15_19	_t	7.9	11.27409	0.7	0.503	-18.09811	33.89811
	_z	-18.7	32.9614	-0.57	0.586	-94.70913	57.30913
	_z_t	-3.7	13.51569	-0.27	0.791	-34.86725	27.46725
	_x116	33.2	52.93616	0.63	0.548	-88.871	155.271
	_x_t116	-24.2	24.17097	-1	0.346	-79.93837	31.53837
	_z_x116	-9.4	57.75183	-0.16	0.875	-142.576	123.776
	_z_x_t116	8.3	28.90217	0.29	0.781	-58.34853	74.94853
	_cons	86.4	25.90095	3.34	0.01	26.6723	146.1277
ttested_nat_m20_24	_t	-5908.3	2176.876	-2.71	0.026	-10928.18	-888.4155
	_z	-18245.7	15162.79	-1.2	0.263	-53211.17	16719.77
	_z_t	5176.8	5387.091	0.96	0.365	-7245.854	17599.45
	_x116	17487.2	5667.174	3.09	0.015	4418.673	30555.73
	_x_t116	-986.5	3208.692	-0.31	0.766	-8385.756	6412.756
	_z_x116	383.2	11100.92	0.03	0.973	-25215.56	25981.96
	_z_x_t116	-7873.6	6435.008	-1.22	0.256	-22712.76	6965.556
	_cons	39929.2	5956.429	6.7	0	26193.65	53664.75
tpos_nat_m20_24.	_t	37.4	26.43678	1.41	0.195	-23.56332	98.36332
	_z	-54.6	126.479	-0.43	0.677	-346.2612	237.0612
	_z_t	-33.6	53.55603	-0.63	0.548	-157.1004	89.90042
	_x116	132	188.5532	0.7	0.504	-302.8045	566.8045
	_x_t116	-112.9	70.00467	-1.61	0.145	-274.331	48.53105
	_z_x116	-132.3	211.94	-0.62	0.55	-621.0345	356.4345
	_z_x_t116	65.8	86.61215	0.76	0.469	-133.928	265.528
	_cons	168.9	28.50644	5.92	0	103.164	234.636

tpos_nat_f20_24	_t	-1542.9	342.6631	-4.5	0.002	-2333.083	-752.7174
	_z	12426.3	13085.79	0.95	0.37	-17749.58	42602.18
	_z_t	-9421.2	4972.544	-1.89	0.095	-20887.91	2045.506
	_x116	20853.09	15683.31	1.33	0.22	-15312.69	57018.87
	_x_t116	-11945.07	7193.722	-1.66	0.135	-28533.82	4643.684
	_z_x116	31130.41	23548.15	1.32	0.223	-23171.71	85432.53
	_z_x_t116	3147.168	9985.803	0.32	0.761	-19880.13	26174.47
	_cons	51726.6	969.806	53.34	0	49490.22	53962.98
ttested_nat_f20_24	_t	9.5	45.436	0.21	0.84	-95.2756	114.2756
	_z	-106.1	183.7759	-0.58	0.58	-529.888	317.688
	_z_t	-24.6	71.31625	-0.34	0.739	-189.0556	139.8556
	_x116	165.8	181.9253	0.91	0.389	-253.7206	585.3206
	_x_t116	-144.7	70.85918	-2.04	0.075	-308.1016	18.70155
	_z_x116	-187.7	237.8988	-0.79	0.453	-736.2955	360.8955
	_z_x_t116	112.4	105.3706	1.07	0.317	-130.585	355.385
	_cons	459.5	105.3704	4.36	0.002	216.5153	702.4847