

**Bachelor of Science in Medicine Degree Program
End of Term Final Report**

Student Name: Achieng Tago

Date: August 5th 2018

Project Title:

Time trends in female sex worker HIV prevalence in Nairobi
County, Kenya (2008-17)

Primary Supervisor Name: Dr. Lyle McKinnon

Department:

Basic Medical Sciences

Co-Supervisor Name: N/A

Department: N/A

Summary (250 words max single spaced):!

The burden of HIV/AIDS has been shown to disproportionately affect certain geographical regions. Many of these hotspot regions are found within Sub-Saharan Africa. With the onset of the UNAIDS 90-90-90 treatment target to end the HIV/AIDS epidemic by the year 2030, focused research efforts are becoming even more important in the African region. It is vital to enhance treatment and prevention efforts to certain key populations, such as female sex workers (FSW), defined as women who trade sexual acts for money, due to the effect that they have on the spread of HIV to the general population. Studies have been previously undertaken to study this key demographic. In this study, long term baseline enrollment data has been collected from FSWs enrolled in Sex Worker Outreach Program (SWOP) clinics in Nairobi County, Kenya. A main finding of this study is that HIV prevalence among this cohort is decreasing by year of enrollment across all 7 SWOP clinics for all age groups. Enrollment data has been analyzed for time trends that have been previously found to affect HIV acquisition.

Student Signature



Primary Supervisor Signature!

Acknowledgments: I gratefully acknowledge the sole or partial funding support from:

H.T. Thorlakson Foundation
Dean, College of Medicine
Research Manitoba

Manitoba Medical Service Foundation (MMSF)
Vice-Dean, Research Rady FHS
Health Sciences Centre Research Foundation
Heart and Stroke Foundation

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Introduction and Background

Human immunodeficiency virus (HIV) targets T cells expressing CD4 within the body's immune system. HIV is spread through body fluids.¹ Continual loss of CD4 cells leads to a weakened immune system, causing HIV infected individuals to have a greater likelihood of acquiring a large number of infections.¹ HIV has several stages, the last and most serious of which is termed acquired immunodeficiency syndrome (AIDS).¹ If untreated, HIV infection typically progresses to AIDS within 5-10 years.² However, with proper antiretroviral treatment (ART), the progression of HIV can be slowed or stopped.¹ Therefore, efforts to stop the spread of HIV/AIDS have largely involved scale up of both prevention and treatment to all those in need. Early ART was shown to lower the incidence of causes of non-AIDS mortality such as cancer and heart disease.²⁻⁴ More importantly, from a public health perspective, clinical trials and observational studies suggest ART lowers the infectiousness of HIV+ individuals, therefore holding potential to have individual and population-level benefits.^{2,4}

Worldwide, greater than 70 million individuals have been infected with HIV, with 35 million HIV associated deaths.⁵ In 2017, there were an estimated 36.9 million individuals living with HIV.⁵ Despite these startling numbers, HIV incidence has been slowly declining over the past two decades.⁶ Enhanced treatment and prevention efforts play a contributing role in this decline.⁶ As well, reducing the cost of ART, or making it available at no cost to the individual has also contributed to this decline.⁷ However, the global burden of HIV is disproportionately balanced, with certain geographical locations still being highly affected by the virus.⁶ In particular, the largest number of HIV infected individuals are in Africa, where almost 1 out of every 25 adults is living with the virus.^{5,8} This amounts to greater than half of HIV infected individuals globally.⁵ Kenya in particular was one of 15 countries that accounted for greater than 75% of all new HIV infections in 2013.⁶ In response to the HIV/AIDS epidemic, the United Nations began the UNAIDS 90-90-90 treatment target, which seeks to have 90% of the total HIV positive population know their status, 90% of all individuals who are HIV positive receiving treatment, and 90% of all those receiving treatment attaining viral load suppression, all by the year 2020.⁹ With the inception of the target, it has become more widely recognized that in order to increase the rate of decrease in new HIV infections, treatment and prevention efforts need to be focused on such key 'geographical hotspots' and populations.^{6,9}

The focus on 'geographical hotspots' has contributed to the African observing decreases in the number of new HIV infections and HIV related deaths.^{6,10,11} This progress enabled the African Region to come closer to fully achieving the United Nations Millennium Development Goal number 6, specifically in terms of combating HIV/AIDS.^{10,12} Full achievement of this goal involves stopping and reversing the spread of HIV/AIDS, as well as providing access to HIV/AIDS treatment to all individuals who need it.¹² However, ending the epidemic all together will not only mean enhanced focus on key regions, it will also mean increasing treatment efforts in key populations, such as sex workers, who are individuals who trade sexual acts for money.^{10,13-16}

Sex workers and their clients are a particularly high risk population in Africa, because most HIV infections in this region are transmitted through sex.¹³ This means targeted efforts to treat HIV, and prevent transmission in this key population will have downstream preventative effects on the clients they serve.^{13,17} However, studies that deal with sex workers have narrowed their focus to surveillance and prevention with few studies describing treatment outcomes.^{18,19} Here we conducted an analysis of long-term HIV time trends in female sex workers (FSWs) enrolled in a large Sex Worker Outreach Program (SWOP) covering all of Nairobi county, Kenya. This study seeks to fill the current gap in sex worker HIV research by combining this trend analysis with

information on treatment for this key population, providing important information on surveillance of the HIV epidemic in this important key population.

Materials and Methods

Sex Worker Outreach Program (SWOP) Clinics

Recognizing that female sex workers (FSW) represent a high risk population, and being aware of the role that this group plays in the transmission of HIV/AIDS inspired the Kenya Aids Control Project (KACP) to make this population their primary focus. The Kenya Aids Control Project (KACP) is a collaborative initiative between the University of Manitoba, and the University of Nairobi, with the home base of the initiative located in the University of Nairobi Institute of Tropical and Infectious Diseases (UNITID) at the College of Health Sciences, Kenyatta Hospital. Through this collaboration, two clinics, one in Majengo and the other in Pumwani, areas known for being sex worker hubs, opened in the 1980's to better serve the FSW population. These first two clinics eventually became the first SWOP clinics in August of 2008. However, these clinics were only able to serve sex workers in these areas, therefore five more clinics were opened throughout Nairobi county, all in key sex worker hot spots.^{20,21} These clinics seek to provide sex workers with accessible HIV prevention and treatment services.

Recruitment of Sex Workers into the Program

Sex workers are recruited into the program using a peer support model.²² Program operators, employed by the clinic, seek out sex workers in hotspot locations and recruit outreach workers by explaining HIV, the program, and how the program seeks to prevent HIV transmission and acquisition in sex workers by providing free and accessible services. Mapping data has been gathered in previous studies in order to provide better estimation for the active female sex worker population in Nairobi county which helps support the choice of SWOP clinic location.^{20,21}

Outreach workers are sex workers who are seen as leaders by sex workers within their communities. KACP provides training to these individuals on how to be a peer leader using the National AIDS and STI Control Programme (NAS COP) training course for peer educators.²³ Outreach workers provide leadership to peer educators and are in charge of supervising HIV services at sex worker hotspots for the clinics.

Peer educators work under outreach workers and provide mentorship to sex workers. They give sex workers information on SWOP services and educate them about the harms of HIV/AIDS. They also serve as an example to other sex workers by showcasing positive preventative behaviours. Both outreach workers and peer educators help recruit sex workers into the program and are payed up to 3000 Kenya Shillings per month, based upon their education level and communication skills.

Enrollment Forms

Data gathered from the analysis is from SWOP clinic enrollment forms. Sex workers entering the program must fill out this form which provides baseline information for each individual (see Table 1). From 2008-2014 the SWOP enrollment forms were produced by the SWOP clinics in conjunction with KACP, this form will be referred to as the 'old form'. From 2014 onwards a new enrollment form was produced by KACP with collaboration from the Ministry of Health branch of the Kenya government, this form will be referred to as the 'new form'. There is some overlap between forms in 2014 where clinics were using both forms.

Eligibility Criteria

Participants for this study are made up of FSWs enrolled in these SWOP clinics which are spread throughout Nairobi county, Kenya. FSWs with a valid age, HIV status and date of enrollment were included in the study. The total number of FSWs who filled in enrollment data was 26,030. This number is representative of all seven SWOP clinics.

Data Analysis

The age of FSWs enrolled in the study was divided into 5 different categories for analysis. Age category 1 included FSWs who were less than 25 years of age at time of enrollment; age category 2 was made up of FSWs between the ages of 25-29 years; age category 3 included FSWs between 30-34 years of age; age category 4 between 35-39 years of age; and age category 5 included FSWs who were 40 years of age or greater at time of enrollment. These age categories were then analyzed according to HIV status to determine prevalence.

The Mantel-Haenzsel Test for Trend was used to determine the statistical significance of HIV prevalence in relation to year of enrollment. This test was also used to analyze time trends for categorical variables such as education level, sexually transmitted infection symptoms, condom use and prior HIV testing. An Independent Samples Kruskal-Wallis Test was used to analyze statistical significance for continuous variables such as age at enrollment, sex worker duration, number of casual clients per week, number of regular partners and number of pregnancies.

Results

The total number of FSWs who filled in an enrollment form between 2008 and 2014 was 26,030. As reflected in Figure 1, HIV prevalence for female sex workers enrolled in the Sex Worker Outreach Program (SWOP) clinics has decreased each year from 2008 to 2017 ($P < 0.0001$). In particular, starting from 2010, HIV prevalence decreased significantly each year in the <25 age group, from 17.5% in 2010-11, 12.16% in 2012-13, 8.27% in 2014-15, and 7.3% in 2016-2017. All other age categories also had a decline in prevalence.

Time trends in variables that are commonly associated with HIV status were also analyzed. Table 1 gives a summary of the baseline enrollment data for the study population. Each variable was analyzed in relation to year of enrollment and baseline HIV status. Both education level as recorded from the old enrollment form and injectable contraception use were not found to differ significantly between groups or by year of enrollment ($P = 0.647$; $P = 0.079$ respectively). However, education level as recorded in the new form was found to differ significantly between groups and by year of enrollment ($P = 0.038$). All other categorical variables were highly significant ($P < 0.0001$). All continuous variables were shown to have statistical significance in terms of HIV status and year of enrollment ($P < 0.0001$). Despite being statistically significant, the absolute differences were relatively modest, therefore, a stratified analysis on baseline enrollment data based on HIV status and year of enrollment was also carried out.

Education Level

The proportion of individuals who reported entering secondary school (old form) has remained fairly constant over time with the lowest rate observed in 2011 at 41.7% entry rate, and the highest in 2009 with 50.9% (Figure 2). Education data from the new enrollment forms and shows a similar trend (Figure 3) in those who have reported completing secondary school with the lowest completion reported being in 2016 at 24% and the highest in 2015 at 28.1%.

Sexually Transmitted Infection Symptoms

Sexually transmitted infection (STI) symptoms are represented in the study by three separate variables: 'ever had genital ulcer', 'ever had foul smelling vaginal discharge', and 'ever had a painless vaginal growth.'

As seen in Figures 4 and 6, study participants who were HIV negative at baseline reported having a decreased prevalence in both the genital ulcer disease and the painless vaginal growth category when compared to the HIV positive cohort in all enrollment years. Figure 5 shows a reversal of this trend with vaginal discharge being roughly equally reported in 2014 by both the HIV negative and positive groups, and being marginally higher in the HIV negative cohort in 2016 and 2017 at 46.6% vs. 46.3% and 50.7% vs. 50% respectively.

Injectable Contraception Use

The proportion of those reporting injectable birth control use has remained fairly steady over time with a peak of 23% reporting in the HIV negative group in 2017, and 23.8% in the HIV positive group for that same year (Figure 7). Overall, the number of individuals reporting use of this contraception has been fairly equal between HIV positive and HIV negative groups with the largest difference being 4.6% in 2016 and no difference between groups reported in 2010.

Condom Use

Condom use among sex workers in the study was determined by data recorded on the variables 'used condom during last sexual encounter', 'always use condom during vaginal sex with casual clients' and 'always use condoms during vaginal sex with regular partners'. A high number of individuals from both the HIV negative and HIV positive groups reported using a condom during their last sexual encounter with the lowest level reported in the HIV negative group being 71.3% in 2011, and 71.5% in 2008 for the HIV positive group (Figure 8). Figure 10 shows a steady increase in the rate of FSWs enrolled in the program who report always using a condom with regular partners during vaginal sex starting from 11.4% in HIV negative individuals in 2008 and reaching 75.3% by 2017. A similar trend is seen for HIV positive individuals enrolled in the program, 18.8% reported always using a condom in 2008 and 77.5% in 2017. The number of sex workers who reported always using a condom with casual clients (Figure 9) did increase in both HIV negative and HIV positive individuals, but not as sharply as condom use with regular partners.

Ever Tested for HIV Before Enrollment into Program

A higher proportion of HIV negative individuals report getting tested for HIV prior to enrollment in the SWOP clinics when compared to HIV positive individuals with the highest difference between groups occurring in 2008 at a difference of 27% (Figure 11). In both HIV negative and HIV positive individuals, prior testing has increased from 2008 to 2017.

Antiretroviral Therapy (ART)

Starting in 2011, time to ART initiation decreased significantly ($P < 0.001$) for each year of enrollment (Figure 12).

Discussion

Data analysis has demonstrated that HIV prevalence in FSWs enrolled in the Sex Worker Outreach Program has been decreasing steadily over time. The prevalence rate in the <25 age group can be used as a surrogate for HIV prevalence because this group is responsible for the majority of new HIV infections in Kenya²⁴. This group saw a marked decrease in prevalence (Figure 1).

This study sought to discover potential confounding variables contributing to the decline in HIV prevalence in the study population by analyzing time trends in enrollment data variables that are often associated with HIV acquisition. The analysis showed that declines in HIV prevalence was consistent across important baseline information (Table 1). However, more work is needed to be able to accurately rule out confounding or defining mediators to the decline in prevalence.

Possible reasons for this decrease in prevalence outside this analysis may stem from prevention and treatment efforts in the general population. Enhancing prevention and treatment efforts towards key populations such as FSWs has been part of a wider initiative to reduce the burden of HIV/AIDS in Kenya.¹² Results of this initiative include an increase by 37% in the number of people receiving antiretroviral therapy (ART), an 11% increase in adults who are still on ART at 60 months, and an 11% increase in the number of individuals with viral load suppression between 2013 and 2015.²⁴

A limitation of this study is that the decreased prevalence in HIV acquisition demonstrated by the data and analysis is only reflective of the FSWs and does not include data on their clients. Therefore, this analysis is unable to determine whether the decreased prevalence in sex workers has seen a corresponding decrease in prevalence in their clients. Despite this, estimations can be made based on data showing the HIV prevalence for men who report paying for sex.²⁵ This data shows that HIV prevalence from 2003 to 2012 did not decrease significantly for men, with rates of 5.6% in 2007 and 4.2% in 2012.²⁵ Another limitation is that it is not possible to enroll every sex worker in Nairobi county. However, according to enumeration studies the estimated FSW population in Nairobi is 27,620 with a range of 21,081 to 34,160.²¹ Although mapping in itself is limited by movement of individuals and therefore these estimations are by their very nature dynamic and cannot represent the total population at all times, the large sample size used for analysis includes a cohort that falls within the estimated range of the enumeration data²¹, helping to ensure the representativeness of the results. HIV positive FSW may also report earlier for programs such as SWOP to seek treatment knowing that freely given ART is available. However, our analysis shows that HIV prevalence is decreasing for those <25 years of age at time of enrollment. Having the enrollment forms change in 2014 was a limitation because it did not allow a longitudinal analysis to be done on certain key variables such as education level and number of boyfriends. However, most variables remained in the same format when changing from the old form to the new form and therefore the longitudinal analysis was largely unaffected.

The major strength of the study is the very large sample size of female sex workers. As well, due to biometric indicators, double enrollment by sex workers into the study was not possible, ensuring the accuracy of the captured baseline information. Having the goals of the program remain the same by maintaining its focus on providing FSWs with accessible services including outreach, treatment and preventative care that is free of judgement is another major strength.

However, the enrollment forms used in the study analysis did not provide incidence data. The incidence data that was attained was not complete (~1% HIV seroconversion rate), therefore, future studies on this key population will require more detailed incidence reports. The ART time to initiation data indicated that with each passing enrollment year, HIV positive individuals were being placed on ART within a shorter period of time. This trend will also need to be further analyzed in future reports.

Tables and Figures

Table 1. Baseline Cohort Characteristics		
Categorical variables, n (%)		
	HIV negative	HIV positive
Education level:		
Attended secondary school (old form)	5,798 (45.1)	1,314 (36.2)
Completed secondary school (new form)	2,081 (26.8)	241 (15.4)
Sexually transmitted infection symptoms:		
Ever had genital ulcer disease	4,839 (23.7)	1,875 (36.3)
Ever had foul smelling vaginal discharge	11,120 (54.5)	3,062 (59.3)
Ever had painless growth in vaginal area	3,779 (18.5)	1,239 (24.1)
Injectable contraception use	4,000 (19.2)	889 (16.9)
Condom use during last sexual encounter	15,325 (75.4)	3,938 (76.9)
Always use condom during vaginal sex with casual clients	15,058 (74.6)	3,529 (69.1)
Always use condom during vaginal sex with regular partners	8,722 (50.3)	2,089 (50.7)
Ever tested for HIV prior to enrollment in SWOP	19,338 (94.3)	4,277 (82.4)
Continuous variables, median (interquartile range)		
	HIV negative	HIV positive
Age at enrollment (years)	28.00 (23.00 – 34.00)	33.00 (28.00 – 39.00)
Sex worker duration (years)	2.42 (1.00 – 4.75)	4.00 (2.00 – 7.50)
Number of casual clients per week	7.00 (4.00 – 14.00)	8.00 (4.00 – 14.00)
Number of regular partners:		
Number of regular partners (old form)	1.00 (1.00 – 3.00)	1.00 (1.00 – 3.00)
Number of boyfriends (new form)	1.00 (1.00 – 1.00)	1.00 (0.00 – 1.00)
Number of pregnancies	2.00 (1.00 – 3.00)	3.00 (2.00 – 4.00)

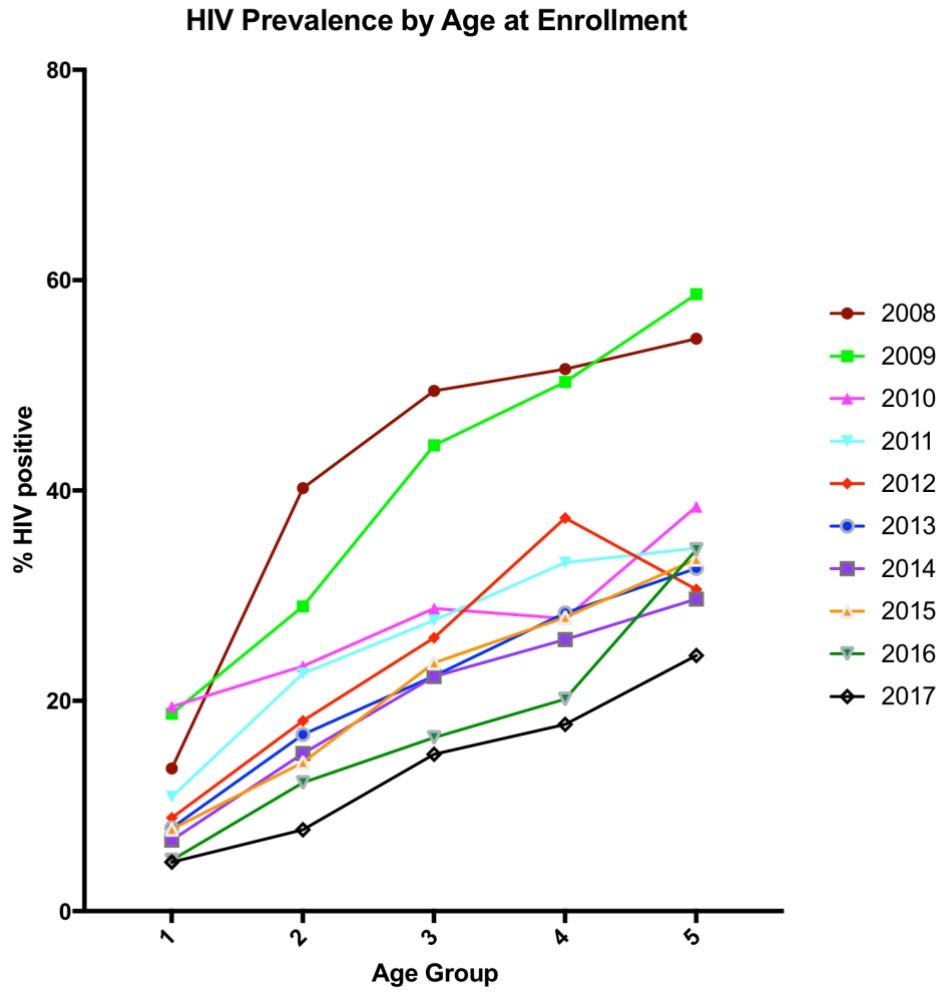


Figure 1

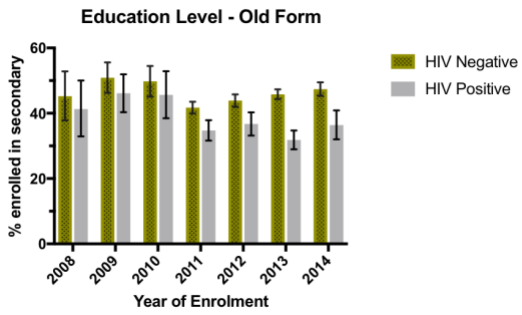


Figure 2

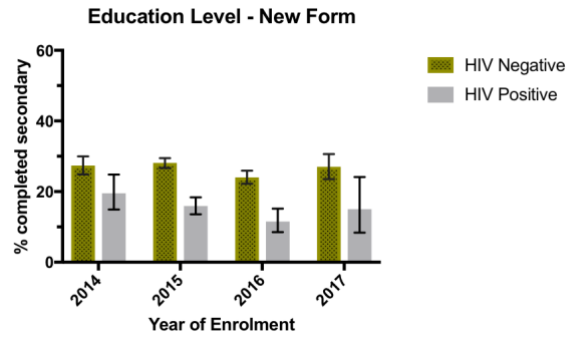


Figure 3

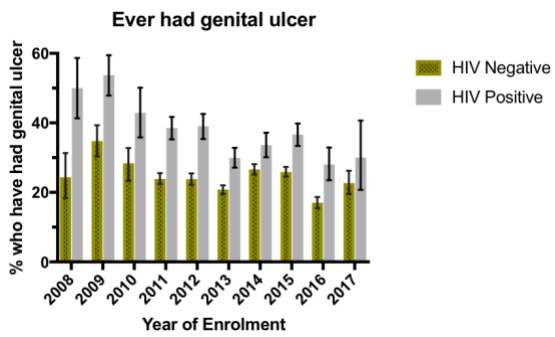


Figure 4

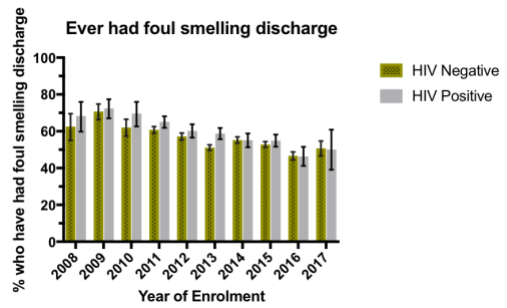


Figure 5

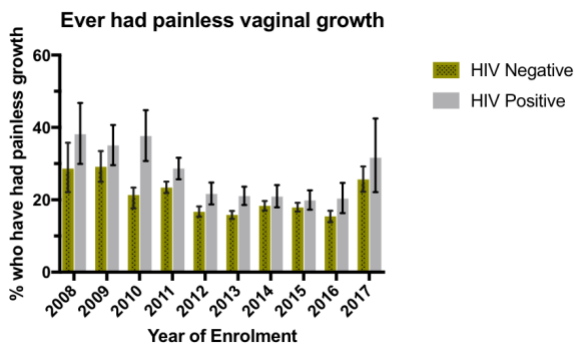


Figure 6

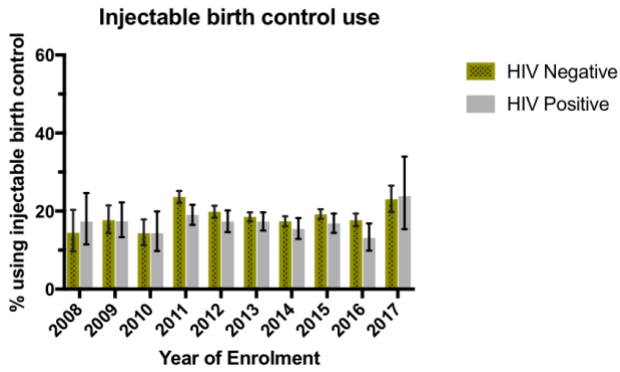


Figure 7

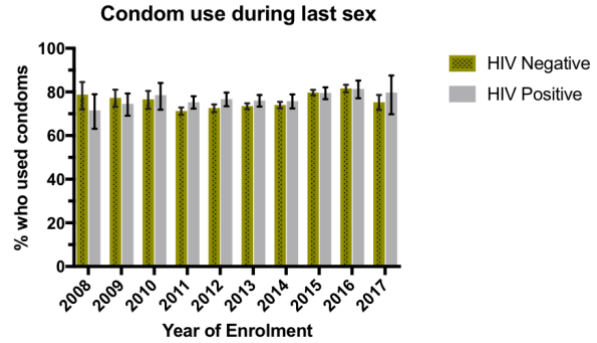


Figure 8

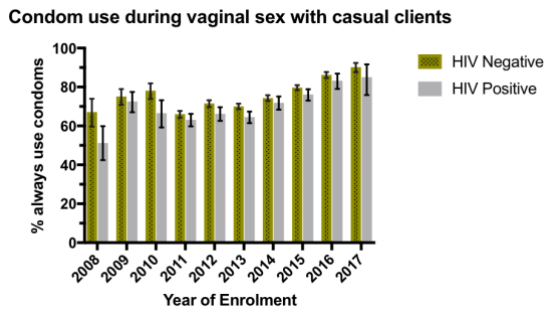


Figure 9

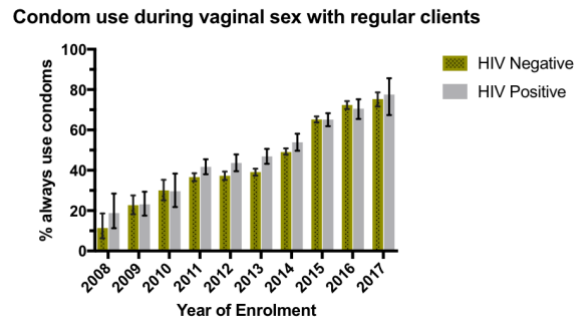


Figure 10

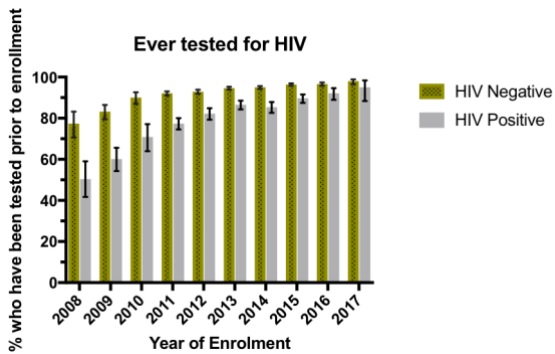


Figure 11

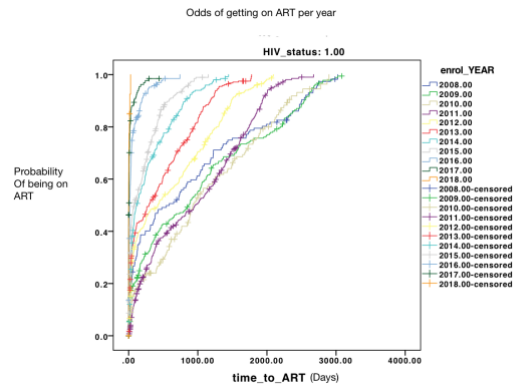


Figure 12

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