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ANC HIV SENTINEL SURVEILLANCE REPORT 2011

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SENTINEL SURVEILLANCE FOR HIV AND SYPHILIS INFECTION AMONG PREGNANT WOMEN FROM ANTENATAL CLINICS IN KENYA

2011

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Acronyms

AIDS	Acquired Immunodeficiency Disease Syndrome
ANC	Antenatal Clinic
ART	Antiretroviral Therapy
CDC	Centers for Disease Control and Prevention
DASCO	District AIDS and STI Coordinator
DBS	Dry Blood Spot
ELISA	Enzyme Linked Immunosorbent Assay
HIV	Human Immunodeficiency Virus
HIVDR	Human Immunodeficiency Virus drug resistance
KAIS	Kenya AIDS Indicator Survey
MOH	Ministry of Health
NASCOP	National AIDS and STIs Control Programme
NHRL	National HIV Reference Laboratory
PMTCT	Prevention of Mother to Child Transmission (of HIV)
RPR	Rapid Plasma Reagent
SS	Sentinel surveillance
SSA	Sub-Saharan Africa
STI	Sexually transmitted infections
UAT	Unlinked Anonymous Testing
VCT	Voluntary Counseling and Testing
VDRL	Venereal Disease Research Laboratory
WHO	World Health Organization

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Foreword

The National AIDS and STI Control Program (NASCOP) have used antenatal care (ANC) sentinel surveillance (SS) data to justify and plan the expansion of HIV prevention, care and treatment services for approximately two decades now. Although methodologies have evolved, the continuity of these data has proved to be of value in monitoring epidemic trends of HIV over time.

This report presents findings from the 2011 round of SS carried out in Kenya. Like in previous years, the main objective of this round of SS was to describe the prevalence and trend of HIV and syphilis infection in Kenya. In addition, the report also describes and compares the prevalence of HIV and syphilis infection between the general and the refugee population. More emphasis was also laid on the recruitment of known HIV-positive pregnant women in this round of SS.

The survey recruited pregnant women from 43 ANC clinics distributed throughout the country and 4 ANC clinics situated in designated refugee camps in Kenya. A cumulative total of 15,149 pregnant women were recruited. The overall prevalence of HIV infection in the general population (7.6% [95% C.I, 7.1 – 8.0]) was ten-fold more than that in the refugee population (0.8 [95% C.I, 0.4 – 1.4]). In contrast, the prevalence of syphilis infection in the refugee population (0.8 [95% C.I, 0.4 – 1.4]) was six-fold more than that in the general population (0.2 [95% C.I, 0.1 – 0.3]).

The observed overall HIV prevalence estimate in this round of SS was substantially higher compared to that reported in the last SS exercise (6.2% [95% C.I, 5.8 – 6.6]). This difference can largely be explained

by the inclusion on known HIV positive women in this year's round of SS. Indeed, excluding known HIV positive women from the analysis resulted to an overall prevalence estimate of 5.9% (95% C.I, 5.5 – 6.3), with no substantial difference when compared to that reported in the last SS exercise.

While the data suggests that the HIV epidemic in the country has largely stabilized, an increase in the prevalence of HIV was observed in some sub-populations: the older (35-49 years) age group, presenting with more than three pregnancies and separated/widowed/divorced women, suggesting an increased survival and a cohort effect. The HIV prevalence was also on an increasing trend in Nyanza province. Strong evidence of a decline in the prevalence of syphilis infection in Kenya was also observed.

Although a good agreement was observed between reported HIV PMTCT and SS results, a validity assessment of the two results suggests that two out of every five HIV infected pregnant women were reported as HIV negative in the PMTCT results.

In summary, the 2011 round of SS reports that the HIV epidemic in Kenya has largely stabilized over the past half a decade. Of good note is the declining trend in the prevalence of syphilis infection in the general population. As a result of the massive public health interventions against the epidemic, HIV infected individuals are now living longer, as has been demonstrated by the increased survival and the cohort effect. Importantly, exclusion of known positive from surveillance program has been shown to have a potential of grossly underestimating the overall prevalence of HIV infection in a population. While HIV infection

remains low in the refugee population, the prevalence of syphilis was found to be unexpectedly high. Amongst the refugee population, a syphilis screening and treatment programme is warranted to prevent perinatal transmission and to reduce the risk of syphilis as a cofactor for HIV transmission**.** Further investigations are also warranted to understand the disparity observed between reported PMTCT and the SS DBS results.

Key Findings and Program Implications

- While the prevalence of HIV infection among pregnant women in the general population was 7.6%, that in the refugee population was 0.8%. The low prevalence in the refugee population is a good reflection of the prevalence of HIV from the refugee's countries of origin and the neighbouring North eastern region.
- The observed prevalence of HIV infection in this years' survey was substantially higher, compared to that reported in the most recent sentinel survey of 2010. This difference is largely explained by the inclusion of known HIV positive women in the present survey. Exclusion of known positives may therefore substantially underestimate the true prevalence of HIV infection in national surveys.
- HIV prevalence was highest in Nyanza province (17.9%) and lowest in North Eastern province (1.4%). An increase in the prevalence of HIV infection over time is also reported from Nyanza province only.
- Of note is the increasing trend in the prevalence of HIV infection in the older generation, with higher number of pregnancies and separated/ divorced/widowed women. This may suggest that HIV infected patients are now living longer and healthier lives, which may be attributed to the scale up of antiretroviral therapy among other public health interventions.
- Persisting disparities between reported PMTCT and DBS sentinel surveillance results are also reported. Investigations are needed to understand the origin and extent of these disparities.
- In contrast, the prevalence of syphilis infection among the refugee population was 0.8% while that in the general population was 0.2%. Syphilis was also found to be a strong cofactor for HIV infection. Interventions targeted at syphilis screening and treatment programmes amongst the refugee population are therefore warranted.

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1.0 INTRODUCTION

HIV/AIDS continues to present a major public health challenge in Sub-Saharan Africa (SSA) where the epidemic is home to an estimated 22.4 million people – around two thirds of people living with HIV globally [1]. In an attempt to monitor trends in the epidemic and provide information on the effectiveness of preventive and control measures, the World Health Organization (WHO) recommends national HIV surveillance programmes [2].

Sentinel Surveillance (SS) programmes conducted in Antenatal Clinics (ANC) have been used by governments and development partners to plan and monitor national HIV response. These programmes have become standard data elements for national projections and international reporting. In some countries, in the absence of better population-based data sources, data from pregnant women attending ANC has evolved over time into proxy estimates of general population prevalence [3]. Not only are pregnant women considered a good proxy for the general population, they are also fairly easy to access: most use antenatal clinic (ANC) services during their pregnancies and, in that context, blood may be drawn for routine testing.

The Kenyan National AIDS and STI Control Programme (NASCOP), under the Ministry of Health (MOH), have used ANC SS data to justify and plan the expansion of HIV prevention, care and treatment services for approximately two decades now. Although methodologies have evolved over time, the continuity of these data has proved to be of value in monitoring epidemic trends of HIV over time.

ANC SS was first rolled out in the country within 13 sites in 1990. Since then, these sites have increased in time and have seen the network of national surveillance sites grow substantially to 43 active ANC SS sites by the end of 2011. Sites have been selected to provide representation at the national level

and can be extrapolated to represent sub national levels. The current sites reflect a substantial amount of the cultural, socio-economic and regional diversity within Kenya.

Results from the most recent round of SS (2010) show the prevalence of HIV amongst pregnant women attending ANC to be 6.2% (95% C.I: 5.8 – 6.6) [4]. Factors associated with HIV infection in this population were older age, higher gravidity and residing in Nyanza province. Generally, women married in monogamous relationships or those with a higher education were less likely to have HIV infection. The data also showed that the HIV epidemic in Kenya has largely stabilized over the past five years. Syphilis infection remained low (<1%) in pregnant women but was strongly correlated with HIV infection.

In addition, a systematic comparison of SS HIV results with PMTCT HIV results was also done to evaluate the quality of routine HIV testing at the ANC clinic. Although a good agreement between PMTCT and SS DBS results was observed, a high false-negative rate was observed for PMTCT test results: one in every four HIV infected pregnant women were recorded as HIV negative based on their PMTCT test result, when compared to the DBS results.

2.0 OBJECTIVES

2.1 General objective:

- To continue monitoring the epidemic among pregnant women in Kenya for planning and evaluation of HIV and AIDS response activities.

2.2 Specific objectives:

- To determine the prevalence and correlates of HIV and syphilis infections among pregnant women attending antenatal care in Kenya
- To assess temporal trends in HIV and syphilis infections in

pregnant women attending antenatal care in Kenya.

- To compare the validity and reliability of PMTCT HIV prevalence with SS HIV prevalence data collected from pregnant women attending antenatal care in Kenya.
- To determine the prevalence and correlates of HIV and syphilis infections among pregnant women attending antenatal care in four refugee camps in Kenya.

3.0 METHODS

3.1 Selection of Sentinel Sites

The 2011 SS round was conducted amongst pregnant women attending 43 ANC designated facilities distributed over the eight provinces, representing a substantial amount of the cultural, socio-economic and regional diversity within Kenya. Surveillance site facilities have historically been considered if they have a functional ANC clinic and laboratory. They must also have sufficient patient turn-out to be able to collect an appropriate sample size within the recommended 3-month surveillance period.

Sites were characterized as urban if > 85% of the pregnant women report that they resided in a location characterized as urban by the Kenyan national census and as rural if > 85% of the pregnant women report they resided in a location characterized as rural. Mixed sites were those with mixed rural and urban/peri-urban populations (15-85% rural).

In addition, the 2011 sentinel surveillance exercise also included participants from the refugee population. Pregnant women were recruited from Kakuma and Daadab. These are the two main camps located in the North eastern province of Kenya with an estimated combined refugee population of more than 500,000 people as at the

end of 2011, most of whom are from the war-torn Somalia 5, 6. Whilst there was only one SS site in Kakuma, Daadab comprised three sites namely Ifo, Dagahaley and Hagadera. All the four refugee sites were considered as rural sites.

3.2 Sampling methods

Sample size determination

Kenya has over years used 400 as the target sample size in urban ANC facilities and 300 for rural sites. This provided a national sample size of approximately 12801 in 2006, 13026 in 2008 and 13926 in 2010 with HIV prevalence estimates of 6.9%, 7.3% and 6.2% respectively. For the 2011 SS round, the sample size for urban sites was 400 while that for rural sites was 300 pregnant women. Mixed sites were also expected to enroll 300 pregnant women. The estimated sample size from all the 43 sites was 14200 pregnant women attending antenatal care for the first time during that pregnancy.

Sampling Period and Frequency

SS data collection is usually done over three consecutive months at a time period set by NASCOP. The 2011 SS round was conducted between September and December 2011. If a site achieved the site-specific maximum sample size as determined above in a period less than three months, data collection was stopped at that site. If a site had not achieved a minimum sample size within the three-month period for reasons beyond their control, the sampling period was extended to ensure a minimum sample size was achieved. This extension did not exceed two weeks.

3.3 Operational procedures

Staffing and training

Pre-surveillance training included clinical HIV testing for PMTCT staff.

SS data collection forms were reviewed to ensure that they captured the necessary data from a surveillance point of view. The ANC surveillance form captured the results of clinical testing performed in the facility (HIV testing through PMTCT program and Syphilis). NASCOP and NHRL staff reinforced the importance of complete and accurate recording of these testing data, which was important in comparing the results of UAT and the PMTCT program. Efforts were also made to strengthen PMTCT data collection in surveillance facilities based upon the comparative results of ANC SS and PMTCT data from 2010.

It was suspected that some sites (un)intentionally excluded known positive pregnant women from prior surveillance exercises. Hence, more emphasis was given to the identification and inclusion of known HIV positive pregnant women in the 2011 surveillance exercise. To this effect, an additional data item was included in the tools for data collection to capture this.

A training schedule with emphasis on proper handling of dried blood spots (DBS), proper identification of eligible clients, and proper documentation of the surveillance process was developed. Representatives participated in a 3-day training of trainers to standardize training materials. Two nurses and two lab techs from each sentinel site were then identified and taken through integrated five day training. An on-site orientation was then given at each sentinel site for all facility staff members, by the trained staff and by the supervision teams during the monthly supervisions. Feedback on site performance and final results from the 2010 ANC SS round were also provided at initial supervisory visit. Supervision visits included comparisons of denominators of the populations tested in PMTCT and ANC. A supervision checklist was used to guide this exercise.

3.4 Data collection

Demographic Data Collection and Forms

Antenatal nurses were used to collect routine demographic data on a standard "Pathological Request Form" (annex 1). Information captured on this form includes: year of birth, gravidity and parity (pregnant women only), rural or peri-urban/urban residence, marital status, education level, offered PMTCT HIV testing, acceptance of PMTCT HIV testing, and results of PMTCT testing. The form was also used to request for other routine ANC laboratory investigations. In ANC SS sites, these tests include hemoglobin and syphilis testing. Other tests that are commonly ordered for pregnant women may include a malaria blood smear. Since this form was also used for other hospital laboratory requisitions, patients meeting the inclusion criteria for SS were identified if the form was labeled "1ST visit at the upper right hand corner.

Pregnant women were consented for HIV testing and counseled as part of their routine PMTCT care. A nationally approved laboratory algorithm for HIV testing was performed using rapid HIV tests. Trained nurses or counselors typically performed HIV counseling and testing in the ANC, providing real-time results to patients. For purposes of lab quality assurance and for comparing PMTCT program results to SS HIV rates, HIV test results were also recorded on pathological request form by the staff performing the tests. In the laboratory, samples from patients meeting eligibility for SS underwent the routine tests as ordered. The ANC profile laboratory tests were performed and the results recorded by the lab tech on the "Pathological Request Form". A laboratory technologist or technician trained in SS then transferred the demographic information (without any personal identifiers), the PMTCT results and the syphilis laboratory test results from the

"Pathological Request Form" to the SS "Form X". A serially created SS identification number was then assigned.

"Form X" was packaged in bound pads of 50 forms. These forms were in duplicates at all sites. One copy of Form X remained at the facility while the other copy accompanied specimen to NASCOP in Nairobi; the capital city of Kenya. The "Pathological Request Form" (with the lab results of the ANC profile) was then promptly returned to the clinic for provision of care.

3.5 Specimen processing

DBS samples were received at the NHRL in Nairobi. A standard filter paper was then labeled with SS ID number. Leftover whole blood samples from the routine tests were then spotted on a labeled standard filter paper. No personal identifiers were included on the DBS.

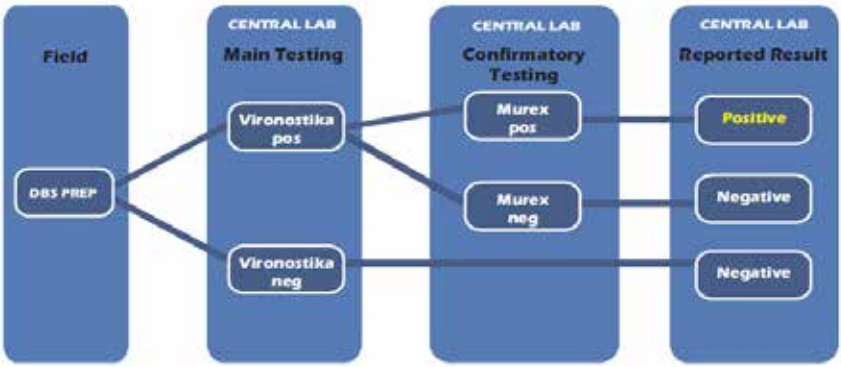
Approximately two drops of remnant blood from the routine antenatal profile sample were placed on each 5 spots of the standard filter paper (Schleicher and Schuell DBS filter paper grade 903), which was then labeled with SS barcode. The barcodes were also fixed on the "Form X, the vacutainer containing the specimen and the specimen/ barcode log. The blood spots were then left to dry in a rack overnight. The dried filter papers were then transferred to a plastic ziplock bag, separated from one another using wax or glycine paper. A dessicant and a humidity indicator strip were also placed in the ziplock bag. If storage was expected for longer than 4 weeks, the bags were stored in refrigerators. Else, the bags were stored at room temperature awaiting pick-up by ANC SS supervision staff.

At the NHRL, specimens were tested according to manufacturer's recommendations. All specimens were subjected to a 4th generation (Vironostika HIV-1/2 antigen/antibody) HIV EIA. Positive specimens

were then subjected to a 3rd generation Murex Antigen/antibody (Murex HIV.1.2.O) HIV EIA. According to the national HIV testing algorirthm, Murex positive specimens were reported as HIV-positive while Vironostika negative and Murex negative specimens were reported as HIV-negative (Figure 1).

For quality assurance purposes, all positives and 5% of negative samples were identified and re-tested at an alternative reference laboratory using the same algorithm. Results from the quality assurance exercise did not affect the final reported results. The remaining samples were stored at –70 degrees centigrade for future testing.

Figure 1: HIV testing algorithm adopted for the 2011 ANC SS round in Kenya



3.6 Data management and data analysis

Data Management

Data from the "Pathological request form" were transferred to a "Surveillance Form X" at the sentinel site by a lab tech. These were remitted to the NASCOP headquarters for central processing and data entry. Double entry was done centrally by two separate data clerks using the national SS data entry screens in EpiInfo.

HIV laboratory data including SS ID number, date of testing, and final

HIV result (positive, negative, indeterminate) were electronically generated at the NHRL. A password-protected database was used for all the data systems. Data were cleaned, merged and analyzed by NASCOP, with support from CDC-Kenya.

Data analysis

Data analysis was guided and conducted according to the WHO recommendations for ANC SS [3]. Selected socio-demographic characteristics of the study population were stratified by site location (i.e. urban, rural, or mixed) and their frequencies (column percentages) summarized in Table 1. To describe the distribution of continuous data elements, both means (with 95% confidence intervals, C.I) and medians (with interquartile ranges, IQR) were presented.

The overall prevalence of HIV and syphilis infection was determined as the number of participants testing positive for HIV or syphilis from the total number of participants tested in all the sentinel sites included in this round of surveillance. Site-specific prevalence estimates were also summarized. A pooled prevalence estimate was computed as a mean of the site-specific prevalence estimates. For both the overall and the mean pooled prevalence estimates, 95% C.I were presented. A median prevalence and IQR of HIV and syphilis infection was also estimated using the site-specific prevalence estimates. The prevalence of HIV and syphilis was also determined for different age groups, site locations, marital status, levels of education, number of pregnancies and provinces.

To assess if there were systematic differences in participants with missing HIV or syphilis data and those without missing data, we cross tabulated the two populations and compared their baseline characteristics using the chi square test. An extra category was created

for missing data and presented in the description of the data.

Random effects logistic regression model was used to analyze the data for correlates of HIV and syphilis infection, adjusting for intra- and inter-site variations. The category with the highest number of participants was considered as the reference category. A forward stepwise model building process was adopted for the multivariable analysis. Odds Ratios (ORs), 95% C.I and likelihood ratio tests (LRT) p-values were presented.

Data from the last four SS rounds were used to assess for temporal trends of HIV and syphilis infection. Maximum likelihood random effects estimation regression models were used to assess for temporal trends of HIV and syphilis infection, effectively adjusting for inter- and intra-site variation. We also used random effects regression models to assess for trends in the prevalence of HIV and syphilis infection among specific socio-demographic characteristics over the four time periods.

To assess the agreement of PMTCT prevalence estimates when compared to DBS SS prevalence estimates over the four SS periods, the kappa statistic was used. To compare the validity of the PMTCT prevalence estimates to that from DBS SS prevalence estimates over the four SS periods, the proportion of true (SS DBS) positives that were test (PMTCT) positive was determined. We also assessed the proportion of true (SS DBS) negatives that were test (PMTCT) negative. All analyses were carried out using STATA statistical software (STATA Intercooled version 11.0, StataCorp, College Station Texas, USA).

3.7 Ethics

Anonymity of SS clients was rudimentary. No information was collected that could link the surveillance ID number to personal identifiers. Since no testing for SS was performed on-site and no personal identifiers were included in either the lab or demographic database; no staff at

facilities or central lab or data processing locations were able to identify any patient's results. To enhance confidentiality, database systems were also password protected. Summary results and laboratory quality assurance reports will be shared with sites, but no line listing or other database that could possibly be used to link results to patients will be provided to facility-level staff. Ethical approval to conduct this round of sentinel surveillance was provided by KEMRI ERC in Kenya and CDC Atlanta.

These results will be presented to the Joint AIDS Programme Review (JAPR) annual meeting for discussion with a broad group of stakeholders that include government, line ministries, community members and civil society leaders, non-governmental organizations and community based organizations including people living with HIV and AIDS, donors, and international technical experts.

4.0 RESULTS

For continuity and comparison purposes with data from prior rounds of sentinel surveillance, data from the general population and that from the refugee population were analyzed and presented separately.

4.1 The general population

4.1.1 Distribution of select characteristics

In the 2011 round of sentinel surveillance in Kenya, 13,526 pregnant women attending care from 43 selected ANC sites were recruited. Of these, the majority (n=5021 [37.1%]) were from urban areas, while the remaining 4812 (35.6%) and 3693 (27.3%) participants were from mixed and rural areas respectively (Table 1). Thika district hospital had the highest number of recruited participants (n=418), while Wesu health centre (n=40) had the least number of recruited participants (Table 2).

Figure 2: Graph showing the distribution of age among pregnant women participating in the 2011 round of SS in Kenya (N=13526).

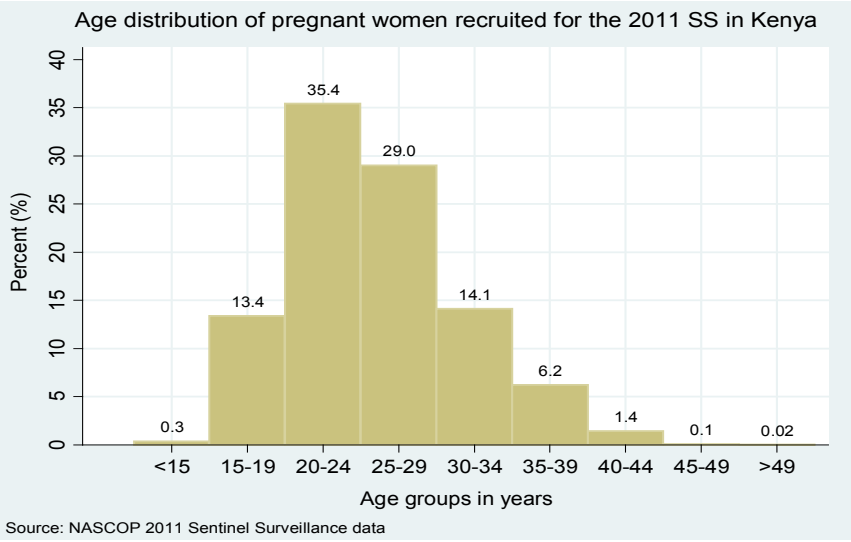


Table 1: Distribution of socio-demographic characteristics amongst pregnant women recruited in the 2011 sentinel surveillance in Kenya (N=13526)

	Categories	Frequency [column %]			
		Urban [n=5021]	**Rural [n=3693]**	**Mixed [n=4812]**	**Total [n=13526]**
Age (years)	**Mean**	25.0	25.7	25.5	25.4
	[min - max]	[12 - 46]	[13 - 54]	[12 - 50]	[12 - 54]
Age group	**<15**	11 [0.2]	13 [0.4]	21 [0.4]	45 [0.3]
	15 –24	2609 [52.0]	1685 [45.6]	2258 [46.9]	6552 [48.4]
	25 –34	2062 [41.1]	1642 [44.5]	2091 [43.5]	5795 [42.8]
	35 –49	311 [6.2]	328 [8.9]	397 [8.3]	1036 [7.7]
	>49	0 [0.0]	2 [0.1]	1 [0.0]	3 [0.0]
	Missing	28 [0.6]	23 [0.6]	44 [0.9]	95 [0.7]

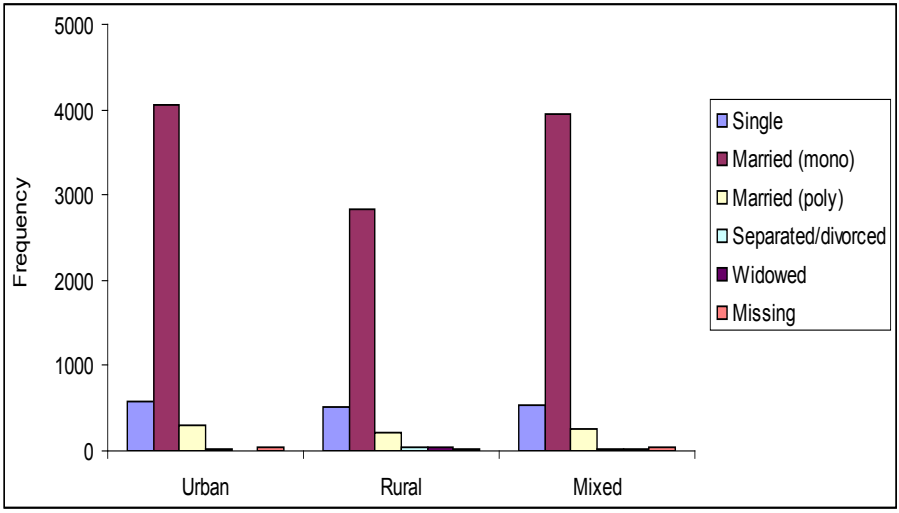
	Categories	Frequency [column %]			
Marital status	**Single**	588 [11.7]	521 [14.1]	536 [11.1]	1645 [12.2]
	Married (monogamous)	4066 [81.0]	2838 [76.9]	3952 [82.1]	10856 [80.3]
	Married (polygamous)	301 [6.0]	220 [6.0]	263 [5.5]	784 [5.8]
	Separated/ divorced/ Widowed	31 [0.6]	87 [2.4]	23 [0.5]	141 [1.0]
	Missing	35 [0.7]	27 [0.7]	38 [0.8]	100 [0.7]
Level of education	**None**	206 [4.1]	217 [5.9]	595 [12.4]	1018 [7.5]
	Primary	2241 [44.6]	1935 [52.4]	2250 [46.8]	6426 [47.5]
	Secondary	1955 [38.9]	1080 [29.2]	1366 [28.4]	4401 [32.5]
	Tertiary	606 [12.1]	448 [12.1]	577 [12.0]	1631 [12.1]
	Missing	13 [0.3]	13 [0.4]	24 [0.5]	50 [0.4]
Gravida	**Mean [min - max]**	2.3 [1 - 13	2.8 [1 – 15]	2.7 [1 – 16]	2.6 [1 – 16]
Gravida group	**0ne**	1643 [32.7]	986 [26.7]	1445 [30.0]	4074 [30.1]
	Two	1616 [32.2]	959 [26.0]	1343 [27.9]	3918 [29.0]
	Three	893 [17.8]	697 [18.9]	840 [17.5]	2430 [18.0]
	More than 3	859 [17.1]	1042 [28.2]	1161 [24.1]	3062 [22.6]
	Missing	10 [0.2]	9 [0.2]	23 [0.5]	42 [0.3]
Province	**Central**	392 [7.8]	628 [17.0]	418 [8.7]	1438 [10.6]
	Coast	416 [8.3]	407 [11.0]	599 [12.5]	1422 [10.5]
	Eastern	0 [0.0]	401 [10.8]	1005 [20.9]	1406 [10.4]
	N. Eastern	0 [0.0]	0 [0.0]	417 [8.7]	417 [3.1]
	Nairobi	2238 [44.6]	0 [0.0]	0 [0.0]	2238 [16.6]
	Nyanza	830 [16.5]	817 [22.1]	0 [0.0]	1647 [12.2]
	R. Valley	730 [14.5]	813 [22.0]	1737 [36.1]	3280 [24.3]
	Western	415 [8.3]	627 [17.0]	636 [13.2]	1678 [12.4]

Distribution by age

The mean age of pregnant women participating in the 2011 round of SS was 25.4 years, with the youngest and the oldest participants being 12 and 54 years respectively. The median age (IQR) was 25 (21-29) years. Almost half the participants were women aged less than 24 years, with the majority of the participants (n=4755 [35.4%]) aged 20 – 24 years (Figure 2). Women in rural areas were older compared to women in urban areas (mean [95% C.I], p-value; 25.7 [25.5 – 25.9] vs 25.0 [24.8 – 25.1]). Of all the participants recruited, 95 (0.7%) had missing data on age.

Distribution by marital status

Figure 3: Graph showing distribution of women participating in the 2011 round of SS by marital status (N=13526)



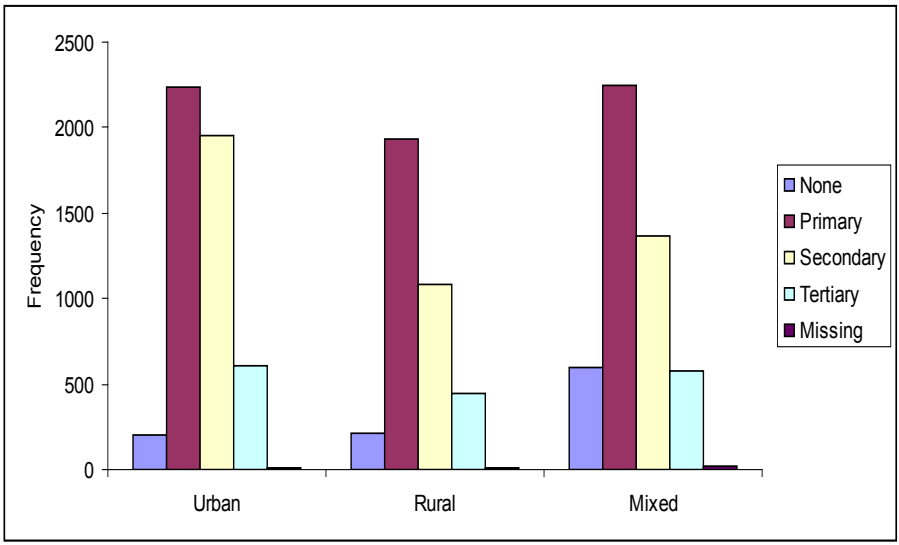
Majority of the recruited participants reported to be married in monogamous relationships (n=10856 [80.3%]). Generally, urban populations reported higher proportions of married women in monogamous relationships (n=4066 [81.0%]) compared to rural

populations (n=2838 [76.9%]) (Figure 3). Overall, 100 (0.7%) of the participants recruited had missing data on marital status.

Distribution by level of education

Almost half of the participants had attained at least primary schooling (n=6426 [47.5%]). Participants from mixed populations had the highest levels of no formal education (n=595 [12.4%]) while those from urban areas had the highest levels of formal education. A higher proportion of women from urban areas (1955 [38.9%]) had attained at least a secondary education compared to those from rural (1080 [29.2%]) and mixed (1366 [28.4%]) populations (Figure 4). Overall, data on level of education was missing from 50 (0.4%) of the recruited participants.

Figure 4: Graph showing distribution of women participating in the 2011 round of SS by level of education (N=13526)

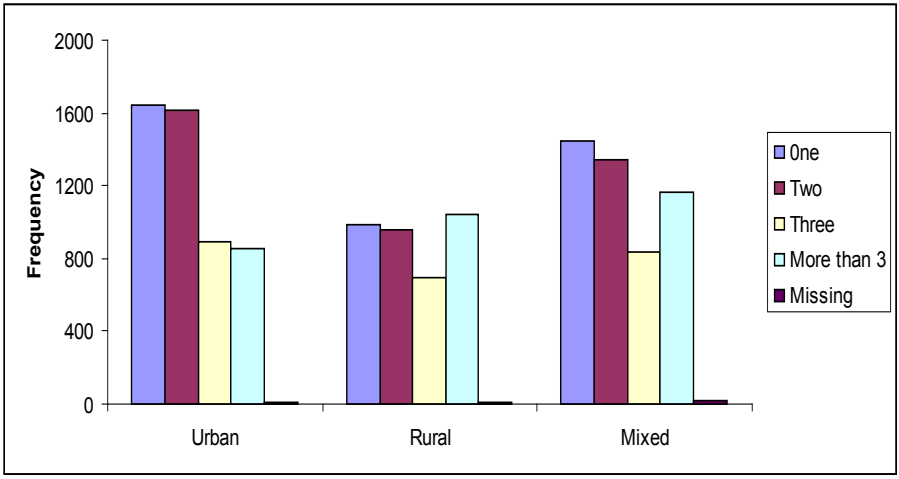


Distribution by number of pregnancies

The mean number of pregnancies amongst women participating in the 2011 round of SS was 2.6 pregnancies, with the smallest number of pregnancies being 1 and the woman with the largest number of

pregnancies carrying her 16th pregnancy. The median number of pregnancies (IQR) was 2 (1-3) pregnancies. Most of the women were in their first pregnancy (n=4074 [30.1%]). Women from rural areas had substantially higher proportions with more than three pregnancies [n=1042 [28.2]) compared to women from urban (n=859 [17.1%]) and mixed areas (n=1161 [24.1]) (Figure 5). Of the women recruited, 42 (0.3%) had missing data on gravidity.

Figure 5: Graph showing distribution of women participating in the 2011 round of SS by level of gravidity (N=13526)



Distribution by province

Majority of the participants were recruited from sites within the Rift Valley province (n=3280 [24.3%]), which comprised 11 of the 43 participating sites. The North Eastern province contributed the least number of participants (n=417 [3.1%]), with only one sentinel surveillance site classified as a mixed site. All the sites from Nairobi were classified as urban and as such, there were no rural or mixed population data from this province. A detailed description of participants' characteristics by provinces is presented in table 2 below.

Table 2: A list of the 43 sites by province and site specific HIV prevalence.

No	Province	Site	Location	Sample size	Prevalence (%)
1	Coast	Bamba	Rural	273	1.5
2		Tiwi	Mixed	188	8.6
3		*Kilifi	Mixed	410	3.9
4		Mombasa	Urban	416	11.1
5		Wesu	Rural	40	2.6
6		Wundanyi	Rural	94	3.3
7	Nairobi	Dandora	Urban	415	9.4
8		*Baba dogo	Urban	375	13.9
9		Riruta	Urban	407	9.8
10		Jericho	Urban	413	8.5
11		Kariobangi	Urban	410	8.1
12		Dagoretti	Urban	174	4.6
13	Central	*Nyeri	Urban	390	5.1
14		Thika	Mixed	418	4.3
15		Njabini	Rural	315	6.7
16		Maragua	Rural	313	8.3
17	Nyanza	Kisumu PGH	Urban	415	15.5
18		Chulaimbo	Rural	264	25.9
19		Suba	Rural	238	30.3
20		Tabaka	Rural	315	19.7
21		Kisii	Urban	415	7.0
22	R. Valley	Nakuru	Urban	415	5.3
23		Fatima	Rural	239	2.9
24		Sirikwa	Mixed	256	7.8
25		Kajiado	Mixed	166	3.0
26		Kaplong	Rural	315	3.5
27		Kitale	Mixed	416	5.1
28		Lodwar	Urban	315	13.1
29		Maralal	Mixed	270	5.0
30		Mosoriot	Rural	259	3.5
31		Baringo	Mixed	315	4.1
32		Turbo	Mixed	314	4.5
33	Western	Kakamega	Mixed	413	5.6
34		Mbale	Rural	315	5.7
35		Mt. Elgon	Mixed	223	2.2

No	Province	Site	Location	Sample size	Prevalence (%)
36		Busia	Urban	415	9.4
37		Teso	Rural	312	4.8
38	Eastern	*Kitui	Mixed	246	5.3
39		*Meru	Mixed	417	4.6
40		Karurumo	Rural	171	4.7
41		Mutomo	Rural	230	3.5
42		*Kangundo	Mixed	300	5.0
43	N. Eastern	Garissa	Mixed	417	1.4
	Pooled estimates	**(Mean) (Median)**			**(7.4) (5.1)**

* Missing results: Baba dogo (n=44), Kitui (n=26), Kangundo (n=15), Nyeri (n=2), Kilifi and Meru (n=1).

4.1.2 Prevalence and correlates of HIV infection

SS DBS results from 89 (0.7%) participants of the total population recruited were missing. There was no substantial difference in the mean age of participants with missing SS results compared to those without missing results (mean [95% CI], p-value: 25.2 [24.1 – 26.3] vs. 25.4 [25.3 – 25.5], p=0.709). Since the proportion of participants missing SS results was so small, subsequent analyses excluded participants with missing SS results. WHO guidelines also recommend ANC SS analysis to be conducted on women aged 15 – 49 years. Pregnant women aged <15 years (n=45) and >49 years (n=3) were hence also excluded from further analysis.

The overall prevalence of HIV infection in pregnant women aged 15-49 years from 43 ANC sentinel sites in Kenya for the year 2011 was 7.6% (95% CI: 7.1 - 8.0). The mean pooled prevalence (95% CI) for all the 43 SS sites was 7.4% (5.5 – 9.2) while the median (IQR) pooled prevalence was 5.1% (3.9 – 8.6). At the site-specific level, Suba reported the highest prevalence of HIV infection at 30.3% (95% C.I: 24.4 – 36.7), followed by Chulaimbo and Tabaka at 25.9% (95% C.I: 20.7 – 31.6) and

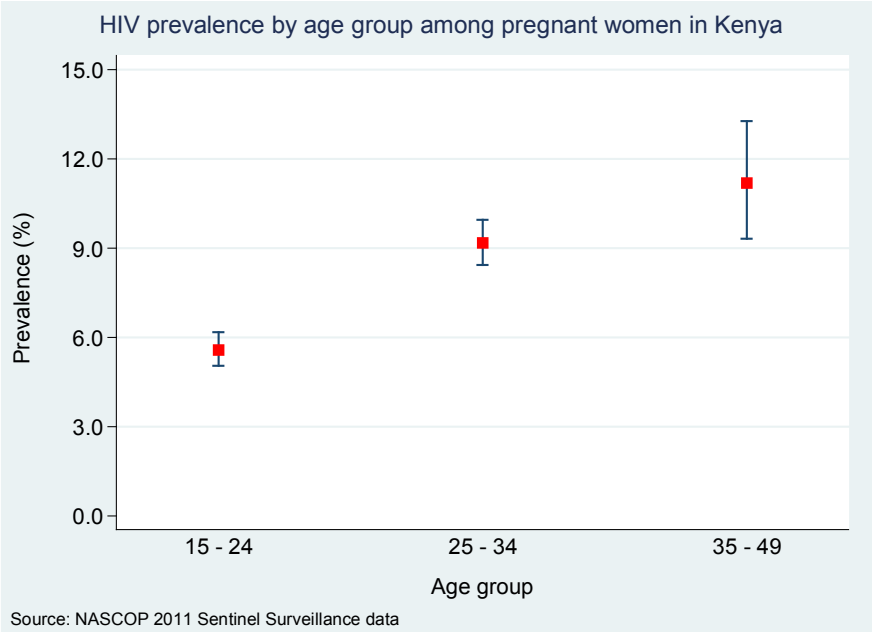
19.7% (95% C.I: 15.4 – 24.5) respectively. Garissa reported the lowest prevalence of HIV infection at 1.4% (95% C.I: 0.5 – 3.1) followed by Bamba and Mt. Elgon at 1.5% (95% C.I: 0.4 – 3.7) and 2.2% (95% C.I: 0.7 – 5.2) respectively. A detailed description of the site-specific SS HIV prevalence is presented in Table 2.

It is prudent to note here that deliberate effort and emphasis was laid on the inclusion of known positives in this round of SS. Excluding known positives from the analysis, the overall HIV prevalence is estimated at 5.9% (95% C.I: 5.5 – 6.3). The mean pooled prevalence is estimated at 5.7% (95% C.I: 4.2 – 7.3) while the median pooled prevalence is estimated at 4.2% (IQR: 2.6 – 6.6). A detailed description of the site-specific SS HIV prevalence, excluding known positives, is presented in annex 5 of this report.

HIV prevalence by age

In the 2011 round of SS, HIV infected pregnant women were older compared to those who tested HIV negative (Mean age [95% C.I: 26.9 [26.6–27.3] vs. 25.3 [25.2–25.4]). There was an increasing trend in the prevalence of HIV with age group; from 5.6% in pregnant women aged 15 – 24 years, to 11.2% in those aged 35 – 49 years (correlation coefficient, p-value: 0.038, p<0.001) (figure 6). Age was strongly associated with HIV infection, even after adjusting for other factors. Compared to those aged 15–24 years old, pregnant women aged 35–49 years old were two fold more likely to be HIV infected (Adjusted Odds Ratio (AOR), [95% C.I], p-value: 2.1 [1.6–2.8], p<0.001) (Table 3).

Figure 6: Graph showing the prevalence of HIV infection by age group among pregnant women recruited for the 2011 round of SS in Kenya (N=13478).



HIV prevalence by site location

There were substantial differences in the prevalence of HIV in pregnant women attending ANC stratified by site locality. Women coming from urban areas had the highest prevalence of HIV at 9.4% (95% C.I: 8.6 – 10.2) while those from mixed populations had a prevalence of 4.6% (95% C.I: 4.0 – 5.2). In the Univariable analysis, women from mixed sites were less likely to be HIV infected, compared to women from urban sites (Crude Odds Ratio (COR), [95% C.I], p-value: 0.5 [0.3 – 0.8], p=0.010) (Table 3). However, site classification was not associated with HIV infection after adjusting for other factors.

HIV prevalence by marital status

The prevalence of HIV differed substantially by marital status, with pregnant women married in monogamous relationships having the lowest prevalence at 6.8% (95% C.I: 6.3 – 7.3) while those women who were separated/divorced/widowed having the highest prevalence at 29.1% (95% C.I: 21.6 – 36.6). Marital status was strongly associated with HIV infection, even after adjusting for other factors. Pregnant women who were separated/divorced/widowed were nearly five times more likely to have HIV infection compared to pregnant married women in monogamous relationships (AOR [95% C.I], p-value: 4.6 [3.0 – 6.9], p<0.001) (Table 3).

HIV prevalence by level of education

Substantial variations were observed in the distribution of HIV prevalence by level of education. Pregnant women with primary education had the highest prevalence of HIV infection (9.3% [95% C.I: 8.6 – 10.0]) while those with a tertiary education had the lowest HIV prevalence (3.8% [95% C.I: 2.8 – 4.7]). Level of education was strongly associated with HIV infection, even after adjusting for other factors. Women with a tertiary education were 60% less likely to have HIV infection, compared to women with primary level education (AOR [95% C.I], p-value: 0.4 [0.3 – 0.5], p<0.001). Interestingly, women with no formal education also had almost half the odds of HIV infection, compared to women with primary level of education, even after adjusting for other factors (AOR [95% C.I], p-value: 0.6 [0.4 – 0.8], p<0.001) (Table 3).

Table 3: Prevalence and correlates of HIV infection amongst pregnant women attending 43 SS sites in Kenya (N=13,294).

				Univariable analysis		Multivariable analysis	
Characteristics	**Categories**	**Frequency [n/N]**	**Prevalence [95% C.I]**	**Crude OR [95% C.I]**	**P-value***	**Adjusted OR [95% C.I]**	**P-value***
Age group	**15–24**	363/6504	5.6 [5.0 – 6.1]	Reference		Reference	
	25– 34	528/5761	9.2 [8.4 – 9.9]	1.9 [1.7 – 2.2]		1.7 [1.4 – 2.0]	
	35 – 49	115/1029	11.2 [9.2 – 13.1]	2.7 [2.1 – 3.4]	<0.001	2.1 [1.6 – 2.8]	<0.001
Site location	**Urban**	468/4964	9.4 [8.6 – 10.2]	Reference			
	Rural	331/3678	9.0 [8.1 – 9.9]	0.7 [0.4 – 1.2]			
	Mixed	217/4747	4.6 [4.0 – 5.2]	0.5 [0.3 – 0.8]	0.010	-	-
Marital status	**Single**	116/1611	7.2 [5.9 – 8.5]	1.0 [0.8 – 1.2]		1.5 [1.2 – 1.9]	
	Married (monogamous)	732/10761	6.8 [6.3 – 7.3]	Reference		Reference	
	Married (polygamous)	115/776	14.8 [12.3 – 17.3]	2.3 [1.8 – 2.8]		2.1 [1.6 – 2.6]	
	Separated/divorced/ widowed	41/141	29.1 [21.6 – 36.6]	5.5 [3.7 – 8.3]	<0.001	4.6 [3.0 – 6.9]	<0.001
Level of education	**None**	45/1009	4.5 [3.2 – 5.7]	0.7 [0.5 – 1.0]		0.6 [0.4 – 0.8]	
	Primary	590/6347	9.3 [8.6 – 10.0]	Reference		Reference	
	Secondary	314/4360	7.2 [6.4 – 8.0]	0.8 [0.7 – 0.9]		0.8 [0.7 – 0.9]	
	Tertiary	61/1623	3.8 [2.8 – 4.7]	0.4 [0.3 – 0.5]	<0.001	0.4 [0.3 – 0.5]	<0.001
Gravida	**0ne**	171/4020	4.3 [3.6 – 4.9]	Reference		Reference	
	Two	293/3872	7.6 [6.7 – 8.4]	1.8 [1.5 – 2.3]		1.7 [1.3 – 2.1]	
	Three	240/2417	9.9 [8.7 – 11.1]	2.5 [2.0 – 3.1]		1.9 [1.5 – 2.4]	
	More than 3	307/3038	10.1 [9.0 – 11.2]	2.7 [2.2 – 3.3]	<0.001	1.7 [1.3 – 2.2]	<0.001

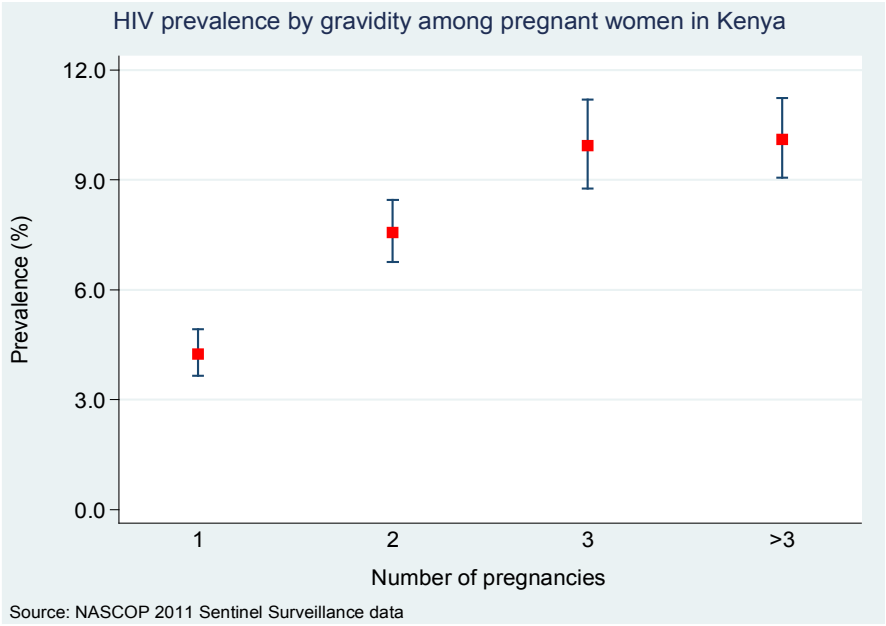
Province	**Central**	85/1533	5.9 [4.7 – 7.2]	1.2 [0.7 – 2.0]		1.1 [0.6 – 1.8]	
	Coast	86/1411	6.1 [4.8 – 7.3]	1.0 [0.6 – 1.7]		1.0 [0.6 – 1.6]	
	Eastern	63.1361	4.6 [3.5 – 5.7]	0.9 [0.5 – 1.5]		0.8 [0.5 – 1.4]	
	N. Eastern	6/417	1.4 [0.3 – 2.6]	0.3 [0.1 – 0.9]		0.4 [0.1 – 1.1]	
	Nairobi	207/2192	9.4 [8.2 – 10.7]	1.9 [1.2 – 2.9]		1.6 [0.9 – 2.7]	
	Nyanza	293/1634	17.9 [16.1 – 19.8]	4.3 [2.7 – 6.8]		4.3 [2.7 – 6.8]	
	R. Valley	176/3265	5.4 [4.6 – 6.2]	Reference		Reference	
	Western	100/1676	6.0 [4.8 – 7.1]	1.1 [0.7 – 1.8]	<0.001	1.0 [0.6 – 1.6]	<0.001
Syphillis (VDRL)	**Negative**	999/13305	7.5 [7.1 - 8.0]	Reference		Reference	
	Positive	11/29	37.9 [20.0 – 56.0]	6.4 [2.9 – 14.0]	<0.001	6.5 [2.9 – 14.5]	<0.001

***Likelihood Ratio Test (LRT) p-value using random effects logistic regression model, adjusting for inter- and intra-site variation.**

HIV prevalence by gravidity

The average number of pregnancies in HIV infected women was substantially higher compared to that in women who tested HIV negative (Mean number of pregnancies [95% C.I], p-value: 2.9 [2.8 – 3.0] vs. 2.6 [2.5 – 2.6], p<0.001). There was an increasing trend in the prevalence of HIV with increasing number of pregnancies; from 4.3% in pregnant women in their first pregnancy, to 10.1% in pregnant women who have had more than three pregnancies (correlation coefficient, p-value: 0.021, p<0.001) (figure 7). Gravidity was strongly associated with HIV infection, even after adjusting for other factors. Compared to women in their first pregnancy, women with more than three pregnancies were almost two fold more likely to be HIV infected (Adjusted Odds Ratio (AOR), [95% C.I], p-value: 1.7 [1.3 – 2.2], p<0.001) (Table 3).

Figure 7: Graph showing the prevalence of HIV infection by gravidity among pregnant women recruited for the 2011 round of SS in Kenya (N=13478).

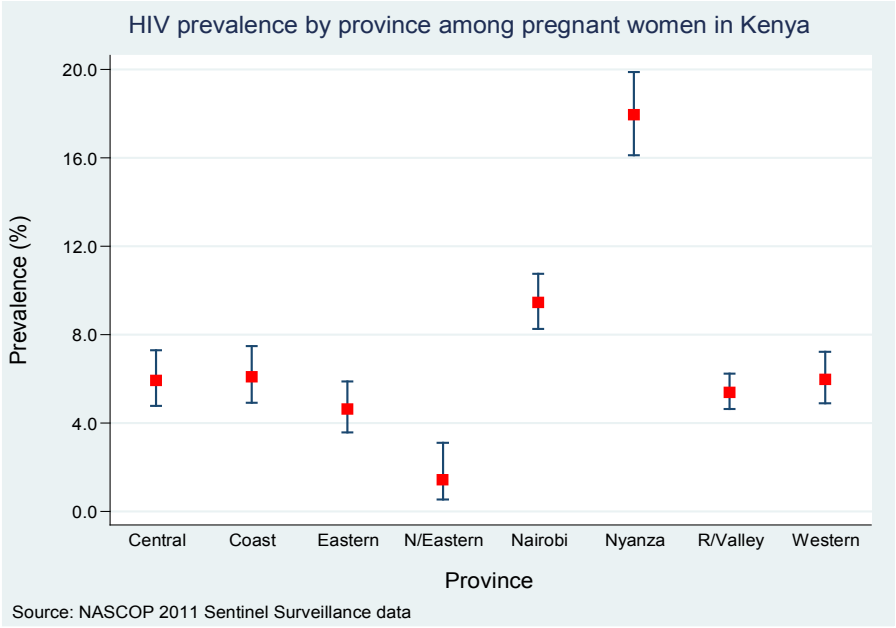


HIV prevalence by province

Pregnant women from Nyanza Province had the highest prevalence of HIV infection at 17.9% (95% C.I: 16.1 – 19.8), followed by Nairobi (9.4% [95% C.I: 8.2 – 10.7]), Coast (6.1% [95% C.I: 4.8 – 7.3]) and Western (6.0% [95% C.I: 4.8 – 7.1]). North Eastern province reported the lowest prevalence of HIV infection at 1.4% (95% C.I: 0.3 – 2.6) followed by Eastern (4.6% [95% C.I: 3.5 – 5.7]), Rift Valley (5.4% [95% C.I: 4.6 – 6.2]) and Central (5.9 [4.7 – 7.2]) provinces respectively (Figure 8). There was a strong association between province and HIV infection, even after adjusting for other factors. Interestingly, except for Nyanza, there were no substantial differences in the risk of HIV infection amongst the other seven provinces, when compared to the Rift Valley province. Pregnant women from Nyanza were more than four-fold more likely

to be HIV infected (AOR [95% C.I], p-value: 4.3 [2.7 – 6.8], p<0.001), compared to those from the Rift Valley (Table 3).

Figure 8: Graph showing the prevalence of HIV infection by province among pregnant women recruited for the 2011 round of SS in Kenya (N=13478).



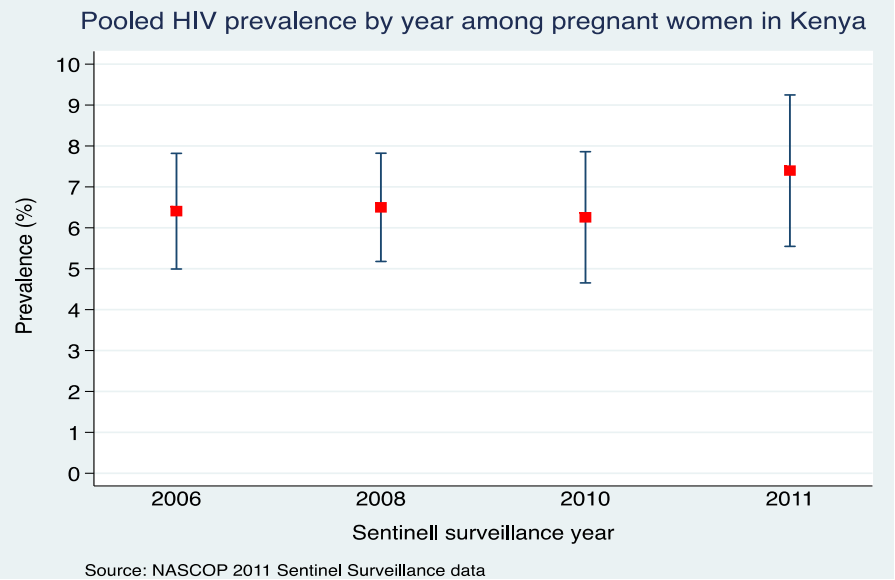
HIV prevalence by syphilis status

Pregnant women who were VDRL positive had the highest HIV prevalence at 37.9% (95% C.I: 20.0 – 56.0), while those who were VDRL negative had a prevalence of 7.5% (95% C.I: 7.1 – 8.0). Syphilis co-infection was found to be strongly associated with HIV infection, even after adjusting for other factors. Compared to pregnant women without syphilis co-infection, women with syphilis co-infection were more than six fold more likely to be HIV infected (AOR [95% C.I], p-value: 6.5 [2.9 – 14.5], p<0.001) (Table 3).

4.1.3 Temporal trends in HIV prevalence

Overall, data collected from the 2006, 2008, 2010 and 2011 rounds of sentinel surveillance suggests that the epidemic has largely stabilized, with poor evidence of any trend in the pooled prevalence of HIV infection amongst pregnant women seeking ANC services in Kenya (correlation coefficient, p-value: 0.003, p=0.116) (Figure 9).

Figure 9: Graph showing temporal trend in the prevalence of HIV infection amongst pregnant women recruited for the Sentinel surveillance in Kenya over four time points (N=172)



Trends in HIV prevalence by age group

Evidence from the four rounds of SS also suggest that the HIV epidemic amongst the youth (15-24 years) and middle aged (25-34 years) pregnant women has also stabilized with poor evidence of any trend in these populations. However, there is strong evidence to suggest that the pooled prevalence of HIV infection amongst the elderly population (35–39 years) is increasing (Coefficient, p-value: 0.017, p=0.001) (Table 4).

Trends in HIV prevalence by site location

Whilst there was some evidence of an increasing trend in the pooled prevalence of HIV infection amongst pregnant women from rural areas (Coefficient, p-value: 0.008, p=0.056), poor evidence to suggest any trend in the pooled prevalence of HIV infection in pregnant women from both urban and mixed areas was found (Table 4).

Trends in HIV prevalence by marital status

Whilst there was poor evidence to suggest any trend in the prevalence of HIV infection amongst women in single relationships and those married in monogamous or polygamous relationships, good evidence of an increasing trend in the prevalence of HIV infection amongst pregnant women who are separated/divorced/widowed was observed (Coefficient, p-value: 0.050, p=0.037) (Table 4).

Trends in HIV prevalence by level of education.

There was poor evidence to suggest any trend in the pooled prevalence of HIV infection in pregnant women with a good (secondary and tertiary) education. However, the data showed strong evidence of an increasing trend in the pooled prevalence of HIV infection amongst pregnant women with lower levels of education, especially those with a primary education (Coefficient, p-value: 0.063, p=0.003) (Table 4).

Table 4: Trends in the pooled prevalence of HIV infection among pregnant women attending antenatal care in Kenya over time, using site-specific prevalence as the unit of analysis (N=172)

Characteristics	Categories	2006 [n=43]	2008 [n=43]	2010 [n=43]	2011 [n=43]	Coef	Const	P-value*
HIV prevalence	-	6.4 [5.0 – 7.8]	6.5 [5.2 – 7.8]	6.3 [4.7 – 7.8]	7.4 [5.6 – 9.2]	0.003	0.062	0.116
Age group	15 –24	5.2 [4.0 – 6.3]	5.0 [3.8 – 6.2]	4.2 [3.2 – 5.3]	5.1 [3.6 – 6.7]	-0.001	0.050	0.612
	25 –34	8.4 [6.3 – 10.4]	8.0 [6.4 – 9.6]	8.3 [5.8 – 10.7]	9.2 [6.8 – 11.7]	0.003	0.080	0.245
	35 – 49	7.0 [3.9 – 10.1]	8.6 [6.4 – 10.8]	9.5 [6.6 – 12.5]	12.2 [8.8 – 15.7]	0.017	0.069	0.001
Site location	Rural	6.1 [3.1 – 9.2]	6.3 [3.3 -9.4]	7.1 [3.3 – 10.8]	8.4 [3.7 – 13.1]	0.008	0.058	0.056
	Urban	8.4 [6.0 – 10.9]	7.9 [6.1 – 9.8]	7.9 [5.4 – 10.4]	9.2 [7.3 – 11.1]	0.003	0.078	0.147
	Mixed	5.1 [3.8 – 6.3]	5.4 [4.0 – 6.9]	4.0 [3.1 – 4.9]	4.7 [3.8 – 5.6]	-0.003	0.052	0.217
Marital status	Single	5.3 [3.8 – 6.7]	6.2 [4.6 – 7.8]	6.3 [4.8 – 7.7]	6.9 [5.2 – 8.7]	0.005	0.054	0.122
	Married (mono)	6.0 [4.6 – 7.5]	6.1 [4.7 – 7.5]	5.8 [4.1 – 7.4]	6.8 [5.0 – 8.5]	0.002	0.059	0.262
	Married (poly)	12.4 [8.3 – 14.9]	11.7 [8.6 – 14.9]	12.8 [8.7 – 16.9]	15.5 [9.6 – 21.4]	0.010	0.115	0.261
	Sepa/divo/Wido	12.6 [3.1 – 22.0]	25.4 [13.5 – 37.4]	15.7 [6.2 – 25.2]	32.6 [20.0 – 45.3]	0.050	0.142	0.037
Level of education	None	9.3 [3.6 – 15.9]	8.6 [1.8 – 15.5]	13.5 [6.1 – 20.8]	11.6 [4.6 – 18.5]	0.012	0.090	0.419
	Primary	6.4 [4.9 – 7.8]	7.3 [5.6 – 8.9]	7.0 [5.3 – 8.7]	8.7 [6.7 – 10.6]	0.007	0.063	0.003
	Secondary	7.1 [5.2 – 1.7]	8.3 [3.8 – 12.7]	5.5 [3.9 – 7.0]	7.4 [5.3 – 9.4]	-0.002	0.073	0.753
	Tertiary	4.6 [2.4 – 6.7]	4.2 [2.4 – 6.0]	2.6 [1.4 – 3.7]	4.1 [2.6 – 5.7]	-0.003	0.042	0.448
Gravida	One	-	3.8 [3.0 – 4.7]	3.4 [2.6 – 4.3]	4.1 [2.9 – 5.3]	0.001	0.035	0.617
	Two	-	7.6 [5.8 – 9.3]	5.8 [4.3 – 7.3]	7.3 [5.4 – 9.1]	-0.002	0.072	0.664
	Three	-	8.3 [6.2 – 10.4]	8.2 [6.0 – 10.4]	9.6 [7.2 – 12.1]	0.007	0.074	0.183
	More than 3	-	7.3 [5.5 – 9.1]	8.7 [6.1 – 11.4	10.4 [7.8 – 13.0]	0.015	0.057	0.005
Province	Central	4.2 [3.3 – 5.2]	4.9 [3.0 – 6.8]	3.5 [2.4 – 4.6]	6.1 [4.2 – 8.0]	0.004	0.041	0.210
	Coast	5.3 [3.5 – 7.0]	5.6 [3.6 – 7.5]	6.0 [2.1 – 9.9]	5.2 [1.9 – 8.4]	0.000	0.055	0.983
	Eastern	5.2 [2.8 – 7.7]	4.6 [1.9 – 7.3]	4.1 [2.7 – 5.6]	4.6 [4.0 – 5.3]	-0.002	0.050	0.401
	N. Eastern	0.6 [n/a]	4.3 [n/a]	2.0 [n/a]	1.4 [n/a]	n/a	n/a	n/a
	Nairobi	8.9 [6.5 – 11.2]	8.2 [6.2 – 10.1]	7.7 [3.9 – 11.5]	9.0 [6.5 – 11.6]	0.000	0.084	0.989
	Nyanza	11.3 [1.1 – 21.4]	13.6 [6.1 – 21.0]	15.4 [6.9 – 23.8]	19.7 [11.1 – 28.2]	0.027	0.109	0.003
	R. Valley	5.4 [4.1 – 6.8]	5.1 [3.5 – 6.7]	4.5 [3.4 – 5.5]	5.3 [3.5 – 7.0]	-0.001	0.052	0.693
	Western	6.0 [4.5 – 7.4]	5.3 [3.0 – 7.5]	4.8 [2.5 – 7.1]	5.6 [3.1 – 8.0]	-0.002	0.056	0.475
Syphilis (VDRL)	Negative	6.4 [5.0 – 7.7]	7.3 [4.9 – 9.7]	6.1 [4.6 – 7.7]	7.3 [5.5 – 9.1]	0.002	0.065	0.568
	Positive	13.3 [1.9 – 24.7]	39.2 [23.6 – 54.9]	22.5 [10.6 – 34.4]	51.8 [26.0 – 77.5]	0.091	0.184	0.018

*** Random effects regression analysis***Trends in HIV prevalence by gravidity*

Data on gravidity was not collected in the 2006 round of SS. Overall, there was strong evidence to suggest an increasing trend in the pooled prevalence of HIV infection in pregnant women with a history of more than three pregnancies (Coefficient, p-value: 0.015, p=0.005). The pooled prevalence of HIV infection in pregnant women with a history of less than three pregnancies remained stable, with the data suggesting poor evidence of any trend over the three SS rounds in these categories (Table 4).

Trends in HIV prevalence by province.

From the provincial level, the data suggests strong evidence of an increasing trend in the pooled prevalence of HIV infection amongst pregnant women in Nyanza over the last four rounds of SS (Coefficient, p-value: 0.027, p=0.003). Interestingly, the pooled HIV prevalence in the remaining seven provinces remained stable over the four SS time points, with poor evidence of an increase or decrease in the pooled HIV prevalence in all these provinces (Table 4).

Trends in HIV prevalence by syphilis infection.

There was good evidence to suggest that the pooled HIV prevalence amongst pregnant women with syphilis co-infection increased over the four SS time points (Coefficient, p-value: 0.091, p=0.018). There was poor evidence to suggest any trend in the prevalence of HIV infection amongst pregnant women who tested VDRL negative over the same time period (Table 4).

A detailed description of the site-specific prevalence of HIV infection in pregnant mothers over the past two decades is also presented (Annex 4).

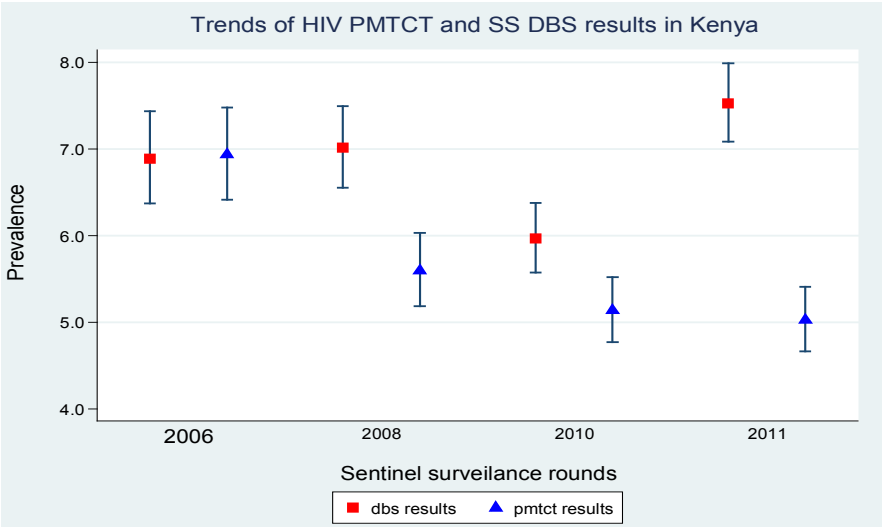
4.1.4 Comparison of PMTCT and SS results of HIV infection

We were also interested in describing the validity and reliability of PMTCT results when compared to the SS DBS results among ANC

SS participants over the four SS time periods. For the purpose of this analysis, we considered the SS DBS results as the referent (gold standard) group. We limited this analysis to participants who had both a PMTCT and a DBS SS test result.

Of the 51,066 pregnant women recruited over the four SS time points, 3528 (6.9%) were missing either PMTCT results or the DBS SS results. Of the 3528 missing results, data from the 2006 surveillance comprised the highest proportion of missing results (n=2932 [83.1%]). Overall, 47,538 pregnant women with both PMTCT and SS DBS HIV result were included in the analysis. Figure 10 below illustrates the distribution of HIV prevalence from PMTCT and SS DBS HIV testing over the four SS time points.

Figure 10: Comparison of HIV prevalence from PMTCT and SS DBS results over the last four rounds of ANC SS, 2006-2011 (N=47538)



Source: NASCOP 2009/2010 Sentinel Surveillance data

Note: Analysis restricted to women with both PMTCT and SS DBS results

Table 5 below describes the validity and reliability of the reported PMTCT results when compared to the DBS SS results over the four SS time points. It is important to note that compared to the other SS years, the difference between PMTCT and DBS SS test results was highest in 2011. Similarly, the sensitivity (proportion of true (DBS) positives who were reported test (PMTCT) positives) was lowest in 2011 at 61.7% (95% C.I: 58.6 – 64.7).

Table 5: Validity and reliability of reported PMTCT results when compared to DBS SS amongst pregnant women recruited for the SS over four time points in Kenya (N=47538)

	2006	2008	2010	2011
Kappa (Agreement)	66.0	87.9	80.6	72.4
Sensitivity (95% C.I)	68.6% [64.7 – 72.2]	79.7% [76.7 – 82.4]	76.0% [73.0 – 78.9]	61.7% [58.6 – 64.7]
Specificity (95% C.I)	97.6% [97.3 – 97.9]	100% [99.9 – 100]	99.4% [99.2 – 99.5]	99.6% [99.5 – 99.7]
***PPV (95% C.I)**	68.1% [64.3 – 71.8]	99.8% [99.1 – 100]	88.3% [85.7 – 90.6]	92.4% [90.1 – 94.3]
****NPV (95% C.I)**	97.7% [97.3 – 98.0]	98.5% [98.2 – 98.7]	98.5% [98.3 – 98.7]	97.0% [96.7 – 97.3]

*** PPV (Positive predictive value), ** (negative predictive value)**

4.1.5 Prevalence and correlates of syphilis infection

Syphilis infection was determined by VDRL status. Of the 13,478 participants aged 15-49 years old and included in the analysis, 55 (0.4%) were missing VDRL status. There were no substantial differences in the mean age of participants with missing VDRL results compared to those without missing VDRL results (mean [95% CI], p-value: 25.6

[23.9 – 27.4] vs. 25.4 [25.3 – 25.5], p=0.781). Since the proportion of participants missing VDRL results was so small, subsequent analyses excluded participants with missing VDRL results.

The overall prevalence of syphilis infection in pregnant women from 43 ANC SS sites in Kenya for the year 2011 was 0.2% [95% Confidence Interval, C.I: 0.1 – 0.3]. The mean pooled prevalence [95% C.I] of syphilis for all the 43 SS sites were 0.2% [0.05 – 0.3] while the median (IQR) pooled prevalence was 0.0% (0.0 – 0.2). At the site specific level, Lodwar reported the highest prevalence of syphilis infection at 2.6%, followed by Nyeri and Dandora at 1.0% each respectively. Twenty nine out of the 43 SS sites did not report any cases of syphilis infection in their participants. A detailed description of the site specific prevalence of syphilis is presented in table 6.

Prevalence of syphilis infection by age

In the 2011 round of SS, there were no substantial differences in the age of pregnant women who tested VDRL positive compared to those who tested VDRL negative (Mean age [95% C.I], p-value: 26.4 [24.0 – 28.7] vs. 25.4 [25.3 – 25.5], p=0.367). Pregnant women aged 35 – 49 years old had a higher prevalence of syphilis infection at 0.3% (95% C.I: 0.1 – 0.8). Compared to those aged 15 – 24 years old, pregnant women aged 35 – 49 years were 60% more likely to be infected with syphilis (COR [95% C.I], p-value: 1.6 [0.5 – 5.8]). However, there was poor evidence to show an association of age with syphilis infection (p=0.692) (Table 6).

Prevalence of syphilis infection by site location

Pregnant women coming from urban areas had the highest prevalence of syphilis infection at 0.4% (95% C.I: 0.2 – 0.6) while those from rural and mixed populations had a prevalence of 0.1% (95% C.I: 0.0 – 0.3)

and 0.1% (95% C.I: 0.0 – 0.2) respectively. There was good evidence to suggest an association between site location and syphilis infection, even after adjusting for other factors. Compared to those from urban areas, women from rural areas were 70% less likely to be infected with syphilis (AOR [95% C.I], p-value: 0.3 [0.1 – 0.9], p=0.014) (Table 6).

Table 6: A list of the 43 sites included in the 2011 sentinel surveillance round by province and site specific prevalence of syphilis (%).

No	Province	Site	Location	Sample size	Prevalence (%)
1	Coast	Bamba	Rural	273	0.0
2		Tiwi	Mixed	188	0.0
3		Kilifi	Mixed	410	0.0
4		Mombasa	Urban	416	0.0
5		Wesu	Rural	40	0.0
6		Wundanyi	Rural	94	0.0
7	Nairobi	Dandora	Urban	415	1.0
8		Baba dogo	Urban	375	0.5
9		Riruta	Urban	407	0.0
10		Jericho	Urban	413	0.0
11		Kariobangi	Urban	410	0.0
12		Dagoretti	Urban	174	0.0
13	Central	Nyeri	Urban	390	1.0
14		Thika	Mixed	418	0.0
15		Njabini	Rural	315	0.0
16		Maragua	Rural	313	0.6
17	Nyanza	Kisumu PGH	Urban	415	0.2
18		Chulaimbo	Rural	264	0.0
19		Suba	Rural	238	0.4
20		Tabaka	Rural	315	0.0
21		Kisii	Urban	415	0.0
22	R. Valley	Nakuru	Urban	415	0.2
23		Fatima	Rural	239	0.0
24		Sirikwa	Mixed	256	0.0
25		Kajiado	Mixed	166	0.0
26		Kaplong	Rural	315	0.3
27		Kitale	Mixed	416	0.2
28		Lodwar	Urban	315	2.6

No	Province	Site	Location	Sample size	Prevalence (%)
29		Maralal	Mixed	270	0.0
30		Mosoriot	Rural	259	0.0
31		Baringo	Mixed	315	0.0
32		Turbo	Mixed	314	0.0
33	Western	Kakamega	Mixed	413	0.2
34		Mbale	Rural	315	0.0
35		Mt. Elgon	Mixed	223	0.0
36		Busia	Urban	415	0.2
37		Teso	Rural	312	0.3
38	Eastern	Kitui	Mixed	246	0.0
39		Meru	Mixed	417	0.2
40		Karurumo	Rural	171	0.0
41		Mutomo	Rural	230	0.0
42		Kangundo	Mixed	300	0.0
43	N. Eastern	Garissa	Mixed	417	0.0
	Pooled estimate	**(Mean)**			**(0.2)**
		(Median)			**(0.0)**

Prevalence of syphilis infection by marital status

Pregnant women married in polygamous relationships had the highest prevalence of syphilis infection at 0.5% (95% C.I: 0.1 – 1.3). Of note, no syphilis infection was found in those pregnant women who were separated/divorced/widowed. When compared to those married in monogamous relationships, pregnant women married in polygamous relationships were 20% more likely to be infected with syphilis (COR [95% C.I]: 1.2 [0.4 – 4.0], p=0.641) (Table 6).

Prevalence of syphilis infection by gravidity

In the 2011 round of SS, there was no significant difference in the average number of pregnancies in syphilis infected pregnant women compared to that in women who were syphilis negative (Mean number of pregancies [95% C.I], p-value: 3.1 [2.4 – 3.8] vs. 2.6 [2.5 – 2.6],

p<0.121). The prevalence of syphilis infection in pregnant women was highest in those women in their third pregnancy (0.4% [95% C.I: 0.2 – 0.7]) and lowest in those women in their first pregnancy (0.1% [95% C.I: 0.0 – 0.2]). Compared to women in their first pregnancy, women in their third pregnancy were more than five-fold more likely to be infected with syphilis (COR [95% C.I]: 5.4 [1.4 – 20.0]) (Table 6).

Prevalence of syphilis infection by province

In the 2011 round of SS in Kenya, pregnant women from Central Province had the highest prevalence of syphilis infection at 0.4% (95% C.I: 0.2 – 0.9), followed by Nairobi (0.3% [95% C.I: 0.1 – 0.6]) and Rift Valley (0.3% [95% C.I: 0.2 – 0.6]). There were no reported cases of syphilis infection in Coast and North Eastern province. When compared to pregnant women from the Rift Valley province, those from the Central province were almost two-fold more likely to be infected with syphilis (COR [95% C.I]: 1.8 [0.3 – 10.6]). However, provincial status was not associated with syphilis infection (p=0.944) (Table 6).

Table 7: Prevalence and correlates of syphilis infection amongst pregnant women attending 43 SS sites in Kenya (N=13,294).

				Univariable analysis		Multivariable analysis	
Characteristics	**Categories**	**Frequency [n/N]**	**Prevalence [95% C.I]**	**Crude OR [95% C.I]**	**P-value***	**Adjusted OR [95% C.I]**	**P-value***
Age group	**15–24**	12/6526	0.2 [0.1 – 0.3]	Reference			
	25– 34	13/5774	0.2 [0.1 – 0.4]	1.3 [0.6 – 2.9]			
	35– 49	3/1032	0.3 [0.1 – 0.8]	1.6 [0.5 – 5.8]	0.692		
Site location	**Urban**	21/4995	0.4 [0.2 – 0.6]	Reference		Reference	
	Rural	5/3670	0.1 [0.0 – 0.3]	0.3 [0.1 – 1.3]		0.3 [0.1 – 0.9]	
	Mixed	3/4758	0.1 [0.0 – 0.2]	0.2 [0.0 – 0.7]	0.036	0.1 [0.0 – 0.5]	0.014
Marital status	**Single**	1/1613	0.1 [0.0 – 0.3]	0.3 [0.0 – 2.1]			
	Married (monogamous)	24/10792	0.2 [0.1 – 0.3]	Reference			
	Married (polygamous)	4/779	0.5 [0.1 – 1.3]	1.2 [0.4 – 4.0]			
	Separated/divorced/widowed	0/140	0.0 [-]	n/a	0.641		
Level of education	**None**	4/1006	0.4 [0.1 – 1.0]	0.8 [0.2 – 3.0]			
	Primary	19/6364	0.3 [0.2 – 0.5]	Reference			
	Secondary	4/4378	0.1 [0.0 – 0.2]	0.3 [0.1 – 0.9]			
	Tertiary	2/1626	0.1 [0.0 – 0.4]	0.4 [0.1 – 1.9]	0.119		
Gravida	**0ne**	3/4029	1.1 [0.0 – 0.2]	Reference			
	Two	10/3882	0.3 [0.1 – 0.5]	3.5 [1.0 – 12.7]			
	Three	9/2420	0.4 [0.2 – 0.7]	5.4 [1.4 – 20.0]			
	More than 3	7/3051	0.2 [0.1 – 0.5]	3.1 [0.8 – 12.1]	0.093		

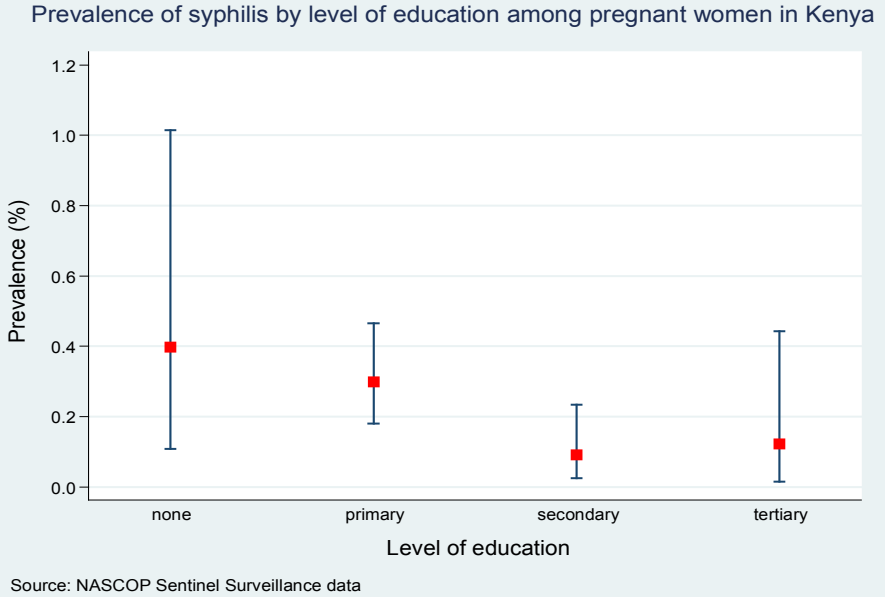
				Univariable analysis		Multivariable analysis	
Province	**Central**	6/1426	0.4 [0.2 – 0.9]	1.8 [0.3 – 10.6]			
	Coast	0/1410	0.0 [n/a]	n/a			
	Eastern	1/1377	0.1 [0.0 – 0.4]	0.3 [0.0 – 3.5]			
	N. Eastern	0/416	0.0 [n/a]	n/a			
	Nairobi	6/2229	0.3 [0.1 – 0.6]	1.0 [0.2 – 5.3]			
	Nyanza	2/1631	0.1 [0.0 – 0.4]	0.5 [0.1 – 4.2]			
	R. Valley	11/3259	0.3 [0.2 – 0.6]	Reference			
	Western	3/1675	0.2 [0.0 – 0.5]	0.8 [0.1 – 5.4]	0.944		
HIV infection	**Negative**	18/12324	0.2 [0.1 – 0.2]	Reference		Reference	
	Positive	11/1010	1.1 [0.5 – 1.9]	6.8 [3.1 – 14.8]	<0.001	7.0 [3.1 – 15.6]	<0.001

***Likelihood Ratio Test (LRT) p-value using random effects logistic regression model, adjusting for inter- and intra-site variation.**

Prevalence of syphilis infection by level of education

Pregnant women with no formal education had the highest prevalence of syphilis infection at 0.4% (95% C.I: 0.1 – 1.0) while those with a tertiary education had the lowest prevalence of syphilis at 0.1% [95% C.I: 0.0 – 0.4]). A decreasing trend in the prevalence of syphilis infection was observed (Coefficient, p-value: -0.0012, p=0.033) (Figure 10). Compared to those with a primary education, pregnant women with a tertiary education had less than half the risk of having syphilis infection (COR [95% C.I]: 0.4 [0.1 – 1.9], p=0.119). However, level of education was not associated with syphilis infection (Table 6).

Figure 11: Graph showing the prevalence of syphilis by level of education among pregnant women recruited for the 2011 round of SS in Kenya (N=13,374)



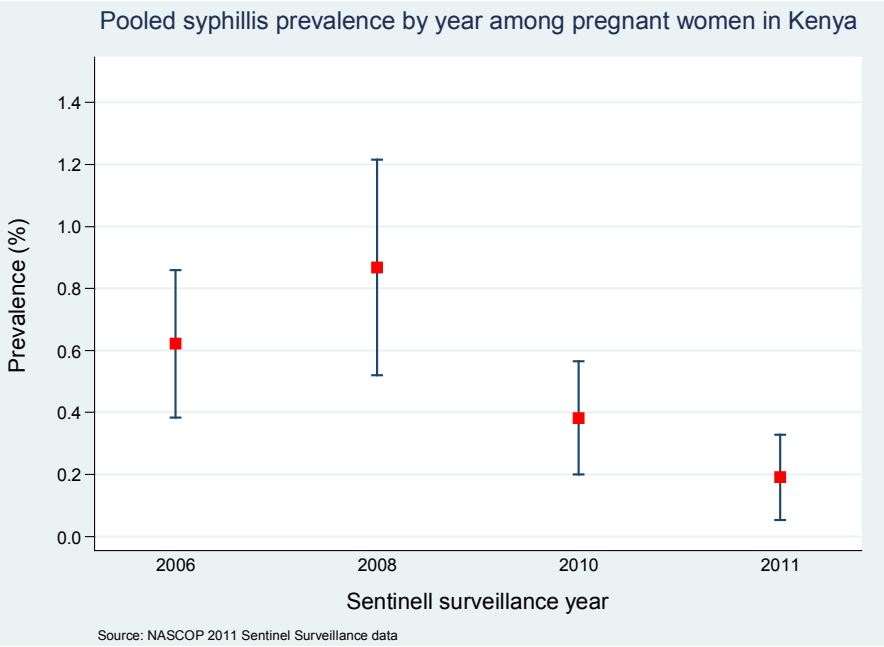
Prevalence of syphilis infection by HIV status

Pregnant women who were HIV positive had the highest prevalence of syphilis at 1.1% (95% C.I: 0.5 – 1.9), while those who were HIV negative had a syphilis prevalence of 0.2% (95% C.I: 0.1 – 0.2). HIV infection was found to be strongly associated with syphilis infection, even after adjusting for other factors. Pregnant women with a HIV infection were seven-fold more likely to be co-infected with syphilis, compared to women without a HIV infection (AOR [95% C.I], p-value: 7.0 [3.1 – 15.6], p<0.001) (Table 6).

4.1.6 Temporal trends in the prevalence of syphilis infection

Overall, data collected from the 2006, 2008, 2010 and 2011 rounds of sentinel surveillance suggest strong evidence of a decreasing trend in the pooled prevalence of syphilis infection amongst pregnant women seeking ANC services in Kenya (Coefficient, p-value: -0.002, p=0.001) (Figure 12).

Figure 12: Graph showing temporal trend in the prevalence of syphilis infection amongst pregnant women recruited for the Sentinel surveillance in Kenya over four time points (N=172)



Trends in the prevalence of syphilis infection by age group

When stratified by age groups, the data suggests strong evidence of a general decrease in the pooled prevalence of syphilis across all the age strata. In particular, the prevalence of syphilis showed a decreasing trend amongst pregnant women aged 15 – 24 (Coefficient, p-value:

-0.002, p=0.001), 25 – 34 (Coefficient, p-value: -0.002, p=0.017) and those aged 35 – 49 (Coefficient, p-value: -0.004, p=0.031) (Table 7).

Trends in the prevalence of syphilis infection by site location

Whilst there was poor evidence to suggest any trend in the pooled prevalence of syphilis amongst pregnant women in rural and urban areas, the data suggest strong evidence of a decrease in the pooled prevalence of syphilis amongst pregnant women in mixed areas (Coefficient, p-value: -0.003, p<0.001) (Table 7).

Trends in the prevalence of syphilis infection by marital status

Whilst there was poor evidence to suggest any trend in the pooled prevalence of syphilis infection amongst pregnant women in single, monogamous and separated/divorced/widowed relationships, the data showed strong evidence of a decreasing trend in the pooled prevalence of syphilis infection amongst pregnant women in polygamous marriages (Coefficient, p-value: -0.002, p=0.001) (Table 7).

Trends in the prevalence of syphilis infection by level of education

There was poor poor evidence to suggest any trend in the pooled prevalence of syphilis infection amongst pregnant women with no formal education and those with a tertiary education. However, there was good evidence to suggest a decreasing trend in the pooled prevalence of syphilis infection amongst pregnant women with a primary education (Coefficient, p-value: -0.002, p<0.001) and those with a secondary education (Coefficient, p-value: 0.002, p=0.033) (Table 7).

Table 8: Trends in the pooled prevalence of syphilis infection among pregnant women attending antenatal care in Kenya over time, using site-specific prevalence as the unit of analysis (N=172)

Characteristics	Categories	2006 [n=43]	2008 [n=43]	2010 [n=43]	2011 [n=43]	Coef	Const	P-value*
HIV prevalence	-	0.6 [0.4 – 0.9]	0.9 [0.5 – 1.2]	0.4 [0.2 – 0.6]	0.2 [0.1 – 0.3]	-0.002	0.008	0.001
Age group	**15 –24**	0.6 [0.3 – 0.8]	0.8 [0.3 – 1.2]	0.2 [0.1 – 0.3]	0.1 [0.0 – 0.2]	-0.002	0.007	0.001
	25 –34	0.6 [0.3 – 0.9]	1.1 [0.6 – 1.5]	0.5 [0.2 – 0.8]	0.2 [0.1 – 0.4]	-0.002	0.009	0.017
	35 – 49	1.5 [0.3 – 2.7]	0.7 [0.2 – 1.3]	0.7 [0.0 – 1.4]	0.3 [0.0 – 0.6]	-0.004	0.013	0.031
Site location	**Rural**	0.3 [0.1 – 0.5]	1.1 [0.4 – 1.9]	0.6 [0.2 – 1.0]	0.1 [0.0 – 0.2	-0.001	0.007	0.344
	Urban	0.7 [0.3 – 1.1]	0.7 [0.2 – 1.2]	0.4 [0.1 – 0.7]	0.4 [0.0 – 0.8]	-0.001	0.007	0.139
	Mixed	0.9 [0.4 – 1.4]	0.7 [0.3 – 1.2]	0.2 [0.0 – 0.3]	0.0 [0.0 – 0.1]	-0.003	0.009	<0.001
Marital status	**Single**	0.5 [0.1 – 0.8]	0.9 [0.2 – 1.6]	0.4 [0.0 – 0.7]	0.1 [0.0 – 0.3]	-0.002	0.007	0.094
	Married (mono)	0.7 [0.2 – 1.2]	0.4 [0.0 – 1.0]	0.8 [0.2 – 1.4]	0.2 [0.0 – 0.4]	-0.001	0.007	0.265
	Married (poly)	0.6 [0.4 – 0.9]	0.9 [0.6 – 1.2]	0.3 [0.1 – 0.5]	0.2 [0.1 – 0.4]	-0.002	0.008	0.001
	Sepa/divo/Wido	0.0 [n/a]	2.0 [0.0 – 5.2]	1.0 [0.0 – 2.9]]	0.0 [n/a]	-0.001	0.009	0.771
Level of education	**None**	0.8 [0.0 – 2.0]	0.2 [0.0 – 0.6]	2.4 [0.0 – 5.7]	0.5 [0.0 – 1.3]	0.001	0.008	0.775
	Primary	0.8 [0.5 – 1.2]	1.0 [0.7 – 1.4]	0.4 [0.2 – 0.5]	0.3 [0.1 – 0.5]	-0.002	0.009	<0.001
	Secondary	0.6 [0.0 – 1.3]	0.8 [0.4 – 1.3]	0.3 [0.0 – 0.6]	0.1 [0.0 – 0.3]	-0.002	0.007	0.033
	Tertiary	0.5 [0.0 – 1.1]	0.5 [0.0 – 1.0]	0.5 [0.0 – 1.0]	0.5 [0.0 – 1.4]	-0.000	0.005	0.990
Gravida	**0ne**	-	0.7 [0.2 – 1.1]	0.4 [0.0 – 0.7]	0.1 [0.0 – 0.1]	-0.003	0.010	0.008
	Two	-	0.6 [0.2 – 1.1]	0.1 [0.0 – 0.2]	0.2 [0.0 - 0.4]	-0.002	0.007	0.032
	Three	-	0.9 [0.4 – 1.4]	0.6 [0.2 – 1.0]	0.3[0.1 – 0.6]	-0.003	0.012	0.039
	More than 3	-	1.3 [0.8 – 1.9]	0.7 [0.3 – 1.1]	0.2 [0.0 – 0.4]	-0.006	0.018	<0.001

Characteristics	Categories	2006 [n=43]	2008 [n=43]	2010 [n=43]	2011 [n=43]	Coef	Const	P-value*
Province	**Central**	0.3 [0.0 – 0.7]	1.9 [0.4 – 3.4]	0.1 [0.0 – 0.3]	0.4 [0.0 – 1.0]	-0.001	0.009	0.526
	Coast	0.7 [0.2 – 1.1]	0.8 [0.0 – 1.8]	0.2 [0.0 – 0.6]	0.0 [n/a]	-0.002	0.008	0.016
	Eastern	1.2 [0.2 – 2.2]	0.5 [0.1 – 0.9]	0.0 [n/a]	0.1 [0.0 – 0.2]	-0.004	0.010	<0.001
	N. Eastern	0.6 [n/a]	0.0 [n/a]	0.0 [n/a]	0.0 [n/a]	n/a	n/a	n/a
	Nairobi	0.7 [0.2 – 1.1]	0.5 [0.1 – 0.8]	0.3 [0.0 – 0.5]	0.2 [0.0 – 0.6]	-0.001	0.006	0.012
	Nyanza	0.1 [0.0 – 0.3]	1.4 [0.0 – 3.4]	1.6 [0.8 – 2.4]	0.1 [0.0 – 0.3]	0.000	0.008	0.923
	R. Valley	0.4 [0.0 – 0.8]	0.6 [0.2 – 1.0]	0.1 [0.0 – 0.2]	0.3 [0.0 – 0.8]	-0.001	0.005	0.275
	Western	1.2[0.0 – 2.4]	1.1 [0.0 – 2.4]	0.6 [0.2 – 1.1]	0.2 [0.0 – 0.3]	-0.004	0.013	0.044
HIV infection	**Negative**	0.6 [0.4 – 0.9]	0.6 [0.3 – 0.9]	0.3 [0.2 – 0.5]	0.1 [0.0 – 0.3]	-0.002	0.007	<0.001
	Positive	1.0 [0.1 – 1.9]	3.9 [2.1 – 5.6]	1.3 [0.4 – 2.3]	0.9 [0.2 – 1.5]	-0.003	0.022	0.276

* **Random effects regression analysis**

Trends in the prevalence of syphilis infection by gravidity

Data on gravidity was not collected in the 2006 round of SS. Overall, there was evidence to suggest a decreasing trend in the pooled prevalence of syphilis infection in pregnant women across all the levels of gravidity. The highest decline was observed in pregnant women reporting more than three pregnancies at their last antenatal visit (Coefficient, p-value: -0.006, p<0.001) (Table 7).

Trends in the prevalence of syphilis infection by province.

Overall, there was poor evidence of any trend in the pooled prevalence of syphilis infection from three provinces (Central, Nyanza and rift valley) in Kenya. The data showed good evidence of a decreasing trend in the pooled prevalence of syphilis infection in Coast, Eastern, Nairobi and Western provinces. The highest decline with the strongest evidence of a decreasing trend in the pooled prevalence of syphilis infection was

observed in Eastern province (Coefficient, p-value: -0.004, p<0.001) (Table 7). It was not possible to assess for trend in North Easter province as it only contributed one site to the sample population.

Trends in the prevalence of syphilis infection by HIV co-infection.

There was poor evidence to suggest any trend in the pooled prevalence of syphilis infection amongst HIV co-infected pregnant women over the four SS time points. However, there was strong evidence to suggest that the pooled prevalence of syphilis infection amongst pregnant women without HIV co-infection decreased over the same time period (Coefficient, p-value: -0.002, p=0.007) (Table 7).

4.2 The refugee population

4.2.1 Distribution of select characteristics

A total of 1643 pregnant women were sampled from four refugee camps in Kenya. Of these, majority were from Kakuma (n=420 [25.9%]). Other sites included Dagahaley (n=400 [24.7%]), Hagadera (n=401 [24.7%]) and Ifo (402 [n=24.8%]) (Table 8).

Distribution by age

The mean age of pregnant women recruited from the refugee camps was 26.0 years, with the youngest and the oldest participants being 12 and 50 years respectively. The median age (Inter-quartile range, IQR) was 25 (21-30) years. Most participants were young women aged 15 – 24 years (n=717 [44.2%]). There were no substantial age differences of the participants by the four sites. Of all the participants recruited, 19 (1.2%) had missing data on age (Table 8).

Distribution by marital status

Majority of the recruited participants reported to be married in monogamous relationships (n=1350 [83.2%]). Generally, Hagadera

reported higher proportions of married women in monogamous relationships (n=363 [90.5%]) compared to the other three sites. Overall, 30 (1.9%) of the participants recruited had missing data on marital status (Table 8).

Distribution by level of education

Majority of the participants had no formal education (n=1384 [85.3%]). Participants from Kakuma had the highest proportion of women with a formal education, with more than a quarter of the participants having attained at least primary education (n=113 [26.9%]). Pregnant women from Hagadera had the highest proportion of pregnant women with no formal education (n=385 [96.0%]). Overall, data on level of education was missing from 10 (0.6%) of the recruited participants (Table 8).

Table 9: Distribution of socio-demographic characteristics amongst pregnant women from refugee camps recruited in the 2011 sentinel surveillance in Kenya (N=1623)

	Categories	Frequency [column %]				
		Dagahaley [n=400]	Hagadera [n=401]	Ifo [n=402]	Kakuma [n=420]	Total [n=1623]
Age (years)	**Mean**	25.5	26.3	26.6	25.5	26.0
	[min - max]	[15 - 45]	[15 - 50]	[12 - 48]	[15 - 45]	[12.0 – 50.0]
Age group	**<15**	0 [0.0]	0 [0.0]	1 [0.3]	0 [0.0]	1 [0.1]
	15 –24	193 [48.3]	153 [38.2]	152 [37.8]	219 [52.1]	717 [44.2]
	25 –34	153 [38.25]	194 [48.4]	177 [44.0]	149 [35.5]	673 [41.5]
	35 –49	54 [13.5]	48 [12.0]	59 [14.7]	51 [12.1]	212 [13.1]
	>49	0 [0.0]	1 [0.3]	0 [0.0]	0 [0.0]	1 [0.1]
	Missing	0 [0.0]	5 [1.3]	13 [3.2]	1 [0.2]	19 [1.2]
Marital status	**Single**	2 [0.5]	0 [0.0]	6 [1.5]	19 [4.5]	27 [1.7]
	Married (mono)	320 [80.0]	363 [90.5]	320 [79.6]	347 [82.6]	1350 [83.2]
	Married (poly)	59 [14.8]	19 [4.7]	62 [15.4]	42 [10.0]	182 [11.2]
	Separated/divorced	16 [4.0]	6 [1.5]	3 [0.8]	2 [0.5]	27 [1.7]
	Widowed	2 [0.5]	1 [0.3]	2 [0.5]	2 [0.5]	7 [0.4]
	Missing	1 [0.3]	12 [3.0]	9 [2.2]	8 [1.9]	30 [1.9]

	Categories	Frequency [column %]				
Level of education	**None**	364 [91.0]	385 [96.0]	363 [90.3]	272 [64.8]	1384 [85.3]
	Primary	33 [8.3]	9 [2.2]	37 [9.2]	113 [26.9]	192 [11.8]
	Secondary	1 [0.3]	2 [0.5]	2 [0.5]	26 [6.2]	31 [1.9]
	Tertiary	1 [0.3]	1 [0.3]	0 [0.0]	4 [1.0]	6 [0.4]
	Missing	1 [0.3]	4 [1.0]	0 [0.0]	5 [1.2]	10 [0.6]
Gravida*	**Mean**	4.6	5.2	4.7	4.3	4.7
	[min - max]	[1 - 15]	[1 - 18]	[1 - 13]	[1 - 13]	[1 - 18]
Gravida group	**0ne**	60 [15.0]	35 [8.7]	57 [14.2]	60 [14.3]	212 [13.1]
	Two	50 [12.5]	52 [13.0]	45 [11.2]	75 [17.9]	222 [13.7]
	Three	52 [13.0]	47 [11.7]	50 [12.4]	49 [11.7]	198 [12.2]
	More than 3	238 [59.5]	266 [66.3]	249 [61.9]	236 [56.2]	989 [60.9]
	Missing	0 [0.0]	1 [0.3]	1 [0.3]	0 [0.0]	2 [0.1]

Distribution by number of pregnancies

The mean number of pregnancies amongst pregnant women from refugee camps participating in the 2011 round of SS was 4.7 pregnancies, with the smallest number of pregnancies being 1 and the largest number of pregnancies carrying her 18th pregnancy. The median number of pregnancies (IQR) was 4 (2-6) pregnancies. At the time of recruitment, majority of the women had previously carried at least three pregnancies (n=989 [60.9%]). Women from Hagadera had substantially higher proportions of women who reported more than three pregnancies [n=266 [66.3%]) while those from Kakuma had the least proportion of women who reported more than three pregnancies (n=236 [56.2%]). Of the women recruited, 2 (0.1%) had missing data on gravidity (Table 8).

4.2.2 Prevalence of HIV and syphilis infection

The overall prevalence of HIV infection in pregnant women aged 15-49 years from four refugee sentinel sites in Kenya for the year 2011 was 0.8% (95% CI: 0.4 – 1.4) while that for syphilis was also 0.8% (95% CI: 0.4 – 1.4). At the site specific level, Ifo had the highest prevalence of HIV infection at 1.5% (95% C.I: 0.6 – 3.2) while Dagahaley and Hagadera

had the lowest prevalence of HIV infection at 0.3% (95% C.I: 0.0 – 1.4). Kakuma had the highest prevalence of syphilis at 1.4% (95% C.I: 0.5 – 3.1) while Dagahaley did not report any cases of syphilis infection (Table 9).

Prevalence of HIV and syphilis infection by age

There were neither differences in the ages of pregnant women with HIV infection compared to those without HIV infection (Mean age [95% C.I], p-value: 27.2 [23.8 – 30.7] vs. 25.9 [25.6 – 26.3], p=0.458), nor differences in those with syphilis infection compared to those without syphilis infection (Mean age [95% C.I], p-value: 28.4 [24.0 – 32.8] vs. 25.9 [25.6 – 26.3], p=0.170). Pregnant women aged 25 – 34 years had the highest prevalence of HIV infection at 1.3% (95% C.I: 0.6 – 2.5) while those aged 15 – 24 had the lowest prevalence at 0.3% (95% C.I: 0.0 – 1.0). Similarly, women aged 25 – 34 years old also had the highest prevalence of syphilis infection at 0.9% (95% C.I: 0.3 – 1.9) while those aged 15 – 24 years old had the lowest prevalence at 0.6% (95% C.I: 0.2 – 1.4) (Table 9).

Prevalence of HIV and syphilis infection by marital status

The prevalence of HIV and syphilis differed by marital status, with pregnant women married in polygamous relationships having the highest prevalence of HIV at 1.7% (95% C.I: 0.3 – 4.8) while those women who were separated/divorced/widowed having the highest prevalence of syphilis at 2.9% (95% C.I: 0.1 – 15.3). No HIV or syphilis infection was detected among single women (Table 9).

Prevalence of HIV and syphilis infection by level of education

Differences were observed in the distribution of HIV prevalence by level of education. Pregnant women with secondary education had the highest prevalence of HIV infection at 3.2% [95% C.I: 0.1 – 16.7]) while

those with a tertiary education were not found with any HIV infection. On the other hand, pregnant women with a primary education had the highest prevalence of syphilis infection at 1.0% (95% C.I: 0.1 – 3.7) while those with a secondary and a tertiary education did not have any cases of syphilis infection (Table 9).

Prevalence of HIV and syphilis infection by gravidity

At the time of the surveillance, there were no differences in the number of pregnancies the average number of pregnancies in women with HIV infection compared to those without HIV (mean number of pregnancies [95% C.I], p-value: 4.8 [3.7 – 5.8] vs. 4.7 [4.6 – 4.8], p=0.921). Similarly, there were no differences in the number of pregnancies amongst women with syphilis infection compared to those without syphilis (mean number of pregnancies [95% C.I], p-value: 5.9 [4.6 – 7.2] vs. 4.7 [4.5 – 4.8], p=0.113).

Table 10: Prevalence of HIV and syphilis infection from select characteristics amongst pregnant women attending 4 SS refugee sites in Kenya (N=1,621).

		Prevalence of HIV		Prevalence of Syphilis	
Characteristics	**Categories**	**Frequency [n/N]**	**Prevalence [95% C.I]**	**Frequency [n/N]**	**Prevalence [95% C.I]**
Site	Dagahaley	1/400	0.3 [0.0 – 1.4]	0/400	0.0 [n/a]
	Hagadera	1/400	0.3 [0.0 – 1.4]	4/399	1.0 [0.3 – 3.0]
	Ifo	6/401	1.5 [0.6 – 3.2]	3/401	0.8 [0.2 – 2.2]
	Kakuma	5/420	1.2 [0.4 – 2.8]	6/418	1.4 [0.5 – 3.1]
Age group	15 –24	2/717	0.3 [0.0 – 1.0]	4/714	0.6 [0.2 – 1.4]
	25 – 34	9/673	1.3 [0.6 – 2.5]	6/673	0.9 [0.3 – 1.9]
	35 – 49	2/212	0.9 [0.1 – 3.4]	2/212	0.9 [0.1 – 3.4]
Marital status	Single	0/27	0.0 [n/a]	0/27	0.0 [n/a]
	Married (monogamous)	9/1350	0.7 [0.3 – 1.3]	10/1347	0.7 [0.4 – 1.4]
	Married (polygamous)	3/180	1.7 [0.3 – 4.8]	1/180	0.6 [0.0 – 3.1]
	Separated/divorced/ widowed	0/34	0.0 [n/a]	1/34	2.9 [0.1 – 15.3]
Level of education	None	10/1382	0.7 [0.3 – 3.7]	11/1381	0.8 [0.4 – 1.4]
	Primary	2/192	1.0 [0.1 – 3.7]	2/192	1.0 [0.1 – 3.7]
	Secondary	1/31	3.2 [0.1 – 16.7]	0/30	0.0 [n/a]
	Tertiary	0/6	0.0 [n/a]	0/6	0.0 [n/a]

		Prevalence of HIV		Prevalence of Syphilis	
Gravida	0ne	1/212	0.5 [0.0 – 2.6]	0/211	0.0 [n/a]
	Two	0/221	0.0 [n/a]	1/221	0.5 [0.0 – 2.5]
	Three	2/198	1.0 [0.1 – 3.6]	1/198	0.5 [0.0 – 2.8]
	More than 3	10/988	1.0 [0.4 – 1.9]	11/986	1.1 [0.6 – 2.0]
Syphilis infection	Negative	12/1605	0.8 [0.4 – 1.3]	-	-
	Positive	1/13	7.7 [0.2 – 36.0]		
HIV infection	Negative	-	-	12/1605	0.8 [0.4 – 1.3]
	Positive			1/13	7.7 [0.2 – 36.0]

Overall 1% (95% C.I: 0.4 – 1.9) of women with three or more pregnancies were infected with HIV whilst those in their second pregnancies were not found to have any HIV infection. Similarly, whilst women with more than three pregnancies had the highest prevalence of syphilis at 1.1% (95% C.I: 0.6 – 2.0), those in their first pregnancy were not found to have any syphilis infection (Table 9).

Prevalence of HIV and syphilis co-infections

Pregnant women who were VDRL positive had the highest HIV prevalence at 7.7% (95% C.I: 0.2 – 36.0), while those who were VDRL negative had the lowest HIV prevalence of 0.8% (95% C.I: 0.4 – 1.3). Similarly, HIV infected pregnant women had the highest prevalence of syphilis infection at 7.7% (95% C.I: 0.2 – 36.0), while those who were HIV negative had the lowest prevalence of syphilis co-infection at 0.8% (95% C.I: 0.4 – 1.3) (Table 9).

We compared the prevalence of HIV and syphilis infection between the pregnant women from the general population participating in ANC sentinel surveillance and pregnant women sampled for sentinel surveillance in the refugee population. There was strong evidence to suggest that pregnant women in the general population were almost ten-fold more likely to be HIV infected compared to those in the refugee population (COR [95% C.I], p-value: 9.8 [3.9 – 24.2, p<0.001]). On the other hand, there was good evidence to suggest that pregnant

women from the refugee population were almost six-fold more likely to be infected with syphilis compared to those in the general population (COR [95% C.I], p-value: 5.7 [1.3 – 225.3, p=0.022]).

Temporal trends

The prevalence of HIV and syphilis infection in refugee camps was generally lower in 2011 compared to that in 2008 (HIV [0.8% vs 1.1%] and syphilis [0.8% vs. 3.1%]). The prevalence of HIV infection increased in one refugee site (Ifo, [0.7% vs. 1.5%)]. The prevalence of syphilis was found to have generally decreased in Dagahaley (3.7 vs. 0.0%), Kakuma (4.0% vs. 1.4%) and Ifo [1.7 vs. 1.0%) from 2008 to 2011, respectively. The prevalence of syphilis infection increased in one of the refugee sites (Hagadera, [0.0% vs. 0.8%)] between 2008 to 2011, respectively. However, it is important to note that these differences were not statistically significant (Table 10).

Due to the low frequency and prevalence of both HIV and syphilis infection in the refugee population, we were unable to conduct any further meaningful analyses on the data.

Table 11: Comparison of the prevalence of HIV and syphilis infection from amongst pregnant women attending 4 SS refugee sites in Kenya between 2008 and 2011.

	Frequency of HIV (Prevalence, %)		Frequency of syphilis (Prevalence, %)	
Sitename	**2008**	**2011**	**2008***	**2011***
Kakuma	9/456 (2.0)	5/420 (1.2)	18/452 (4.0)	6/418 (1.4)
Hagadera	1/83 (1.2)	1/400 (0.3)	0/83 (0.0)	3/401 (0.8)
Dagahaley	1/378 (0.3)	1/400 (0.3)	14/377 (3.7)	0/400 (0.0)
Ifo	2/292 (0.7)	6/401 (1.5)	5/291 (1.7)	4/399 (1.0)
Overall	13/1209 (1.1)	13/1621 (0.8)	37/1203 (3.1)	13/1618 (0.8)

***Missing data: 2008 (n=6 [0.5%]) participants and 2011 (n=3 [0.2%]) participants.

5.0 DISCUSSION

Data from the 2011 round of SS suggests that almost eight out of every one hundred pregnant women attending ANC in Kenya were infected with HIV, while two out of every one thousand pregnant women had syphilis infection. Eight out of every one thousand pregnant women attending ANC from four refugees camps were found to be infected with either HIV and/or syphilis infection.

Whilst the prevalence of HIV infection in the general population remained high, we found substantially lower prevalence of HIV infection in the refugee population. In fact, pregnant women were almost ten fold more likely to be HIV infected in the general population, when compared to the refugee population. The low HIV prevalence in the refugee population largely mirrors that of the population in the North Eastern province of Kenya, which borders Somalia. Majority of the refugees in the camps come from Somalia. The disparity in the HIV prevalence in this population, when compared to the general population, may hence be largely explained by the social, cultural and religious factors.

On the contrary, the prevalence of syphilis in the refugee population was significantly higher compared to that in the general population. Pregnant women from the refugee population were six fold more likely to be infected with syphilis, compared to the general population. Interestingly, we did not find any syphilis infection in the North Eastern province of Kenya. Similar findings of high syphilis prevalence with low HIV prevalence have been previously reported amongst displaced pregnant women elsewhere [7]. Syphilis infection serves as a proxy for unprotected sex and is a known risk factor for HIV acquisition. Therefore, trends in syphilis infection could portent upcoming trends

in HIV infection. Interventions targeted towards safe sex practices may thus be warranted in this population.

To improve the quality of data collected and to ensure that all HIV positive pregnant women were sampled, a few recommendations were made from the 2010 SS exercise. More emphasis was made on sampling not only the newly diagnosed HIV positive mothers coming for antenatal care, but also the known positives so as to give a true reflection of the prevalence of HIV in pregnant mothers seeking antenatal care. This approach, to some extent, may explain the substantial increase in the overall prevalence of HIV observed in 2011, compared to that reported in 2010. Indeed, the observed overall HIV prevalence closely reflects the true prevalence of HIV as reported in other population-based surveys, including the 2008 – 2009 Kenya demographic health survey [8] and the Kenya AIDS indicator survey [9-11]. This may in fact suggest that compared to the preceding SS exercises, the 2011 SS data is the closest reflection of the true HIV prevalence amongst pregnant women in Kenya. Importantly, these findings also suggest that exclusion of known positives from sentinel surveillance program may grossly underestimate the true prevalence of HIV infection in pregnant women in a country.

Whilst age, marital status, level of education, number of pregnancies, provinces and syphilis co-infection were independently associated with HIV infection, only site location and HIV co-infection were independently associated with syphilis infection.

Older pregnant women were more likely to be HIV infected compared to their younger counterparts. Moreover, the prevalence of HIV infection increased with age and was highest in the oldest age group (35 – 49 years). On the other hand, a similar dose response relationship

was also established for HIV infection with increasing number of pregnancies. These same trends were reported in the 2010 SS report [4]. Increasing number of pregnancies is correlated with increasing age. These findings may therefore be interpreted as the results of a cohort effect i.e. increased survival rate of this cohort of women. The increased survival rates and improved quality of life maybe as a result of the scale up of various HIV interventions, including the availability of antiretroviral therapy.

Separated/Divorced/Widowed women were almost five-fold more likely to be HIV infected compared to married women in monogamous relationships. Widowed women may be more likely to have already acquired HIV infection from their husbands who may have died from HIV/AIDS. It is also possible that widowed women may be acquiring HIV infection through unprotected sex with other partners for other reasons, including economic sustainability and wife inheritance in some societies. Interventions are therefore needed to identify and target this group for linkage to care and treatment services. Prevention with positive programs that support HIV infected widowed women are needed to address the high vulnerability of this sub-population.

Pregnant women with a tertiary education were less likely to be HIV infected, compared to those with a primary education. Similar findings were reported in the 2010 round of SS [4]. Campaigns and interventions implemented by the Kenyan government towards enhancing girl-child education are recommended as they have the potential to not only empower the girl child in decision-making, but also have the potential to curb the HIV epidemic in the long term.

Similar variations from previous round of ANC SS were observed in the distribution of HIV prevalence amongst the diverse geographic

regions ranging from the highest prevalence of 17.9% in Nyanza province and the lowest prevalence of 1.4% in North Eastern province. However, the increasing trend in the prevalence of HIV and syphilis infection in Nyanza province, despite massive campaigns to curb HIV/AIDS transmission is concerning. While increases in HIV prevalence may, to some extent, be due to improved HIV-related survival in the community, increases in syphilis infection suggest that sexual risk-reduction behavior has not improved. A better understanding of socio-behavioral and cultural characteristics between these societies is needed to recommend alternative public health interventions and sustained behavioral change.

Our data also suggests that pregnant women with syphilis infection are more likely to have HIV infection and vice versa. Interventions targeted at preventing, diagnosing and early treatment of syphilis in pregnant women have the potential to not only decrease the prevalence of syphilis, but also reduce the likelihood of HIV acquisition.

Overall, data from the last four sentinel surveillance time points suggest that the HIV epidemic has largely stabilized, with pooled prevalence ranging between 6.4 and 7.4%. On the contrary however, the prevalence of syphilis infection has remained low and has continued to decline over the last half a decade in Kenya. It is important to note that whilst most indicators describing the temporal HIV trends had remained stable over the last five years, there was sufficient evidence to suggest that the prevalence of HIV may actually be on the increase in some sub-populations. Good examples of indicators suggesting a temporal increase in the prevalence of HIV include pregnant women aged 35 – 39 years, living in rural areas, separated/widowed/divorced, with a low level education, with more than three pregnancies, coming from

Nyanza province and with a negative VDRL. In summary, these results largely complement our prior hypothesis of an increased survival and the resulting cohort effect.

An assessment of the reliability of PMTCT data to report HIV infection compared to the DBS SS data in the current round of SS showed a poor agreement of the results. An assessment of the validity of the two test results also showed substantial differences, with the low sensitivity of the PMTCT result at 62% - in other words suggesting that out of every ten pregnant women who were truly HIV infected, only six were reported HIV positive during routine HIV testing at the PMTCT program. These data therefore warrant further audits in the dynamics and algorithms of HIV PMTCT testing and result documentation.

Recently, suggestions have been made to move away from using DBS for SS and advocate use of PMTCT data instead. If implemented, this may result to a gross underestimation of the true national prevalence of HIV infection amongst pregnant women in the country. Further exploration is therefore warranted to understand the extent of the disparity observed between SS DBS results and the reported PMTCT results.

5.1 Limitations

Caution should be applied when interpreting these surveillance data. Women who do not attend ANC are often more likely to be less literate, older and coming from rural areas compared to those attending ANC. The prevalence of HIV and syphilis amongst non-attending women is therefore likely to be lower than among those attending ANC [3], which in our case may have resulted to an overestimation of the prevalence of HIV and syphilis infection.

Exclusion of private clinics is also a limitation in the generalizability of these findings to the country as a whole. Although majority of the women in Kenya attend public antenatal clinics and the impact of excluding private antenatal clinics may then be negligible, a substantial proportion of women from urban areas may be using private antenatal clinics, which may result to a significant difference in HIV and syphilis prevalence.

Given that women of younger age groups (15 – 24 years) are known to engage more in unprotected sex suggesting riskier behavior, the HIV prevalence of 5.6% observed in the general population and 0.3% observed in the refugee population may then be considered to be an overestimate of the true prevalence in the general population. Men are also more likely to become infected at an older age than women [3], hence the prevalence observed cannot be extrapolated to men of similar age group in the general population.

We used multivariable analysis to assess correlates of HIV and syphilis infection in the general population. Even though the data suggests that except for site location, all the other risk factors assessed were correlated with HIV infection, we cannot rule out the possibility that we only controlled for partial confounding. It is also possible that other factors not captured in this analysis may have confounded the effect of the available factors on HIV infection. For example, socio-economic status has been found to be an important risk factor for HIV and syphilis infection in our setting [12, 13].

5.2 Conclusion

In conclusion, the 2011 round of SS report suggests that the HIV epidemic in Kenya has largely stabilized over the past half a decade. Of

good note is the declining trend in the prevalence of syphilis infection in the general population. As a result of the massive public health interventions against the epidemic, HIV infected individuals are also living longer, as has been demonstrated by the increased survival and the cohort effect. Importantly, exclusion of known positive from surveillance program has been shown to have a potential of grossly underestimating the overall prevalence of HIV infection in a population. Whilst HIV infection remains low in the refugee population, the prevalence of syphilis was found to be unexpectedly high. AMONGST THE REFUGEE POPULATION, A syphilis screening and treatment programme is warranted to prevent perinatal transmission and to reduce the risk of syphilis as a cofactor for HIV transmission.

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7.0 ANNEXES

Annex 1: Pathological lab request form

1st Visit

REPUBLIC OF KENYA
MINISTRY OF PUBLIC HEALTH AND SANITATION
REQUEST FOR PATHOLOGICAL INVESTIGATION

Patient's Name……ANC No……

Date of request……Home District……

Nationality……

Residence: Rural ☐ Urban ☐

Sex: M ☐ F ☐ Year of birth 19…… Age in years ……

Marital status **(Tick Appropriate Answer)**
1. Single 2. Married Monogamous 3. Married Polygamous
4. Separated/Divorced 5. Widowed

Education **(Choose one only)** **(Years completed)**
1. No Education 2. Primary Education ☐
3. Secondary Education 4. College Education (Post secondary) ☐

Parity …… + …… Gravidity_____

Has the client been offered HIV Test within PMTCT or other settings? [ ] Yes [ ] No

Has the client accepted HIV Test within PMTCT? [ ] Yes [ ] No

PMTCT Test result 1. Positive 2. Negative 3 . Indeterminate

Specimen……

Examination required……

Doctor's Name…… Doctor's signature……

Date of collection ……

Results ……

……

……

Lab. Tech. Name……Lab. Tech. Sign……

Annex 2: Form X

REPUBLIC OF KENYA
MINISTRY OF PUBLIC HEALTH AND SANITATION
NATIONAL ANC HIV SURVEILLANCE FORM X

Hospital/Health centre……..Site Code……..Serial No……
(Stick Bar code above)

1. **Date of specimen collection** Day……Month……Year…….

2. **Residence** 1.[ ] Rural 2. [ ] Urban

3. **Parity:** _____ + _____Gravidity_____

4. **Year of birth: 19……** Age in years …….

5. **Marital status (tick only one)** 1 [] Single 2 [] Married – monogamous
3 [] Married – polygamous
4 [] Separated/divorced 5 [] Widowed

6. Education (tick only one)
1[ ] No education
2[ ] Primary education: years completed ……
3[ ] Secondary education: years completed ……
4[ ] College (or other higher education institution)

1. **Has the client been offered HIV Test within PMTCT or other settings?** [ ] Yes [ ] No
2. **Has the client accepted HIV Test within PMTCT?** [ ] Yes [ ] No

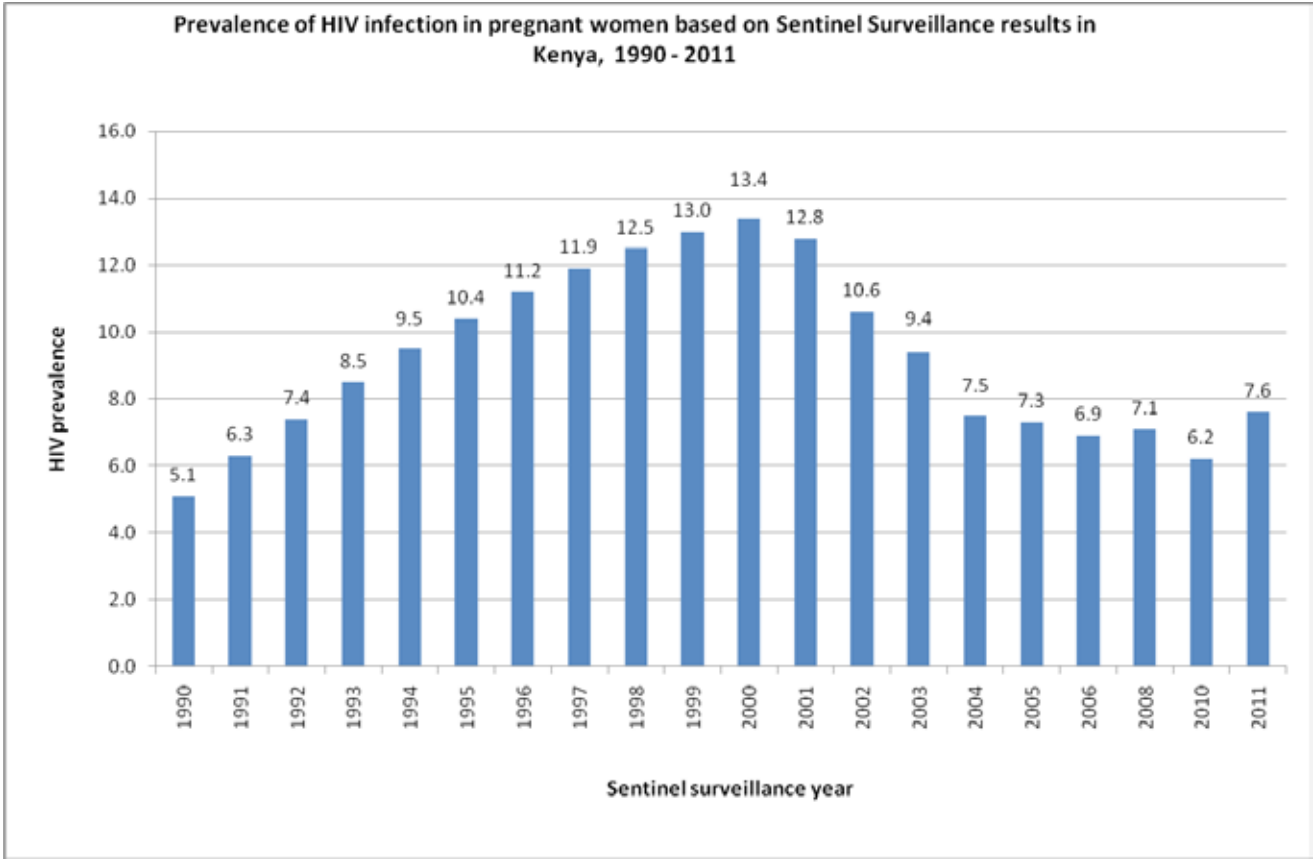
3. **Screening results:** 1. Positive 2.Negative 3 . Indeterminate
HIV Test results (PMTCT) [ ] [ ] [ ]
VDRL (RPR) [ ] [ ]
[ ]

NOTE:
FOR ALL CLIENTS COLLECT A DBS SAMPLE

Name: …… Date DBS spotted……

Signature.....

Annex 3: HIV infection in pregnant women attending ANC in Kenya, 1990 – 2011.



Annex 4: Site specific SS HIV prevalence (1990 – 2011).

	Clients	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2008	2010	2011*
Baba Dogo	Urban																			15.0	13.9
Bamba	Rural							1					9	5	1	1.6	2.	3.2	1.8	1.6	1.5
Baringo	Mixed												10	6	4	6.0	3.9	5.9	7.0	3.8	4.1
Busia	Urban	16	9	29	21	22	21	27	28	28	32	20	15	16	16	15.6	14.2	7.8	6.6	8.2	9.4
Chulaimbo	Rural						20	26		35	24	29	25	22	22	13.8	8.3	8.2	21.0	22.1	25.9
Dagoreti	Urban																			2.0	4.6
Dandora	Urban																			8.0	9.4
Fatima	Rural												22	8	10	6.7	3.8	6.8	4.5	2.3	2.9
Garissa	Mixed	4		4	3	14	5	4	7	4	4		9	4	2	0.4	1.3	0.6	4.3	2.3	1.4
Jericho	Urban																			4.4	8.5
Kajiado	Mixed						5	6	9	6			8	5	4	2.0	3.1	4.4	7.0	5.6	3.0
Kakamega	Mixed	4	12	14	8	13	11	9	9	14	10	10	11	14	13	9.1	9.4	7.7	7.7	5.1	5.6
Kangundo	Mixed												14	7	4	4.9	5.1	4.1	7.2	4.5	5.0
Kaplong	Rural							3	5	4	4	2	9	6	3	3.1	3.6	5.4	4.8	3.5	3.5
Kariobangi	Urban																			9.4	8.1
Karurumo	Rural					1	9		26	10			6	4	7	3.4	3.0	3.5	5.3	4.3	4.7
Kilifi	Mixed												10	5	8	4.0	4.7	2.7	4.6	3.4	3.9
Kisii	Urban	1	3	0	2	8	3	15	15	13	11	14	17	14	9	6.4	7.0	2.3	6.8	8.7	7.0
Kisumu PGH	Urban	18	18	19	19	29	24	26	32	27	25	33	29	26	26	11.2	15.1	18.5	16.9	18.5	15.5
Kitale	Mixed	2	5	20	7	10	9	11	12	8	16	15	13	16	11	6.9	5.3	4.8	10.6	8.0	5.1
Kitui	Mixed	0	4	1	7	19	3	3	5	8	7	12	17	6	6	6.0	7.5	9.8	7.2	6.4	5.3

Lodwar	Urban												16	18	13	11.3	7.4	9.0	5.1	4.8	13.1
Maragua	Rural								10	5		8	8	8	5	6.3	5.0	4.5	6.8	4.4	8.3
Maralal	Mixed												15	13	18	8.2	3.7	7.2	0.8	4.5	5.0
Mbale	Rural					11	10		15	10	11	23	11	11	8	9.8	9.5	5.4	6.2	5.7	5.7
Meru	Mixed	2			1	10	8	15	13	21	28	23	10	5	8	3.3	4.9	4.3	0.8	2.7	4.6
Mombasa	Urban	9	16	10	16	10	15	11	16	14		10	14	15	16	10.3	11.2	5.8	8.2	6.0	11.1
Mosoriot	Rural					1	12		8	1	1	5	4	3	3	4.6	4.3	4.0	3.5	5.1	3.5
Mt. Elgon	Mixed												21	6	5	5.0	5.0	4.7	3.9	1.7	2.2
Mutomo	Rural												2	5	4	5.1	3.4	4.4	2.5	2.8	3.5
Nairobi	Urban	5	12	13	17	15	16	16			17	!7	14	13	11	10.9	10.9	10.1	8.3		
Nakuru	Urban	9	12	12	22		26	10	24	23	25	9	12	12	10	7.0	7.15	10.8	5.9	6.3	5.3
Njabini	Rural								4	2		7	6	6	10	9.9	6.6	3.5	2.6	3.2	6.7
Nyeri	Urban	2	3	8	2	5	20	8	6	15		12	11	8	8	5.5	5.3	4.6	4.4	4.1	5.1
Riruta	Urban																			7.7	9.8
Sirikwa-Turbo	Rural												5	5	4	5.0	3.6	3.5	3.3	2.9	
Suba	Rural												31	34	41	30.0	32.9	26.3	19.9	23.5	30.3
Tabaka	Rural												11	4	9	3.2	3.2	1.1	3.4	3.2	19.7
Teso	Rural													6		3.8	4.5	4.3	1.8	3.2	4.8
Thika	Mixed	2	9	2	27	39		12	18	31	16	19	11	7	8	8.3	7.6	5.1	5.8	2.2	4.3
Tiwi	Mixed					16	23			31	21	12	10	7	10	7.1	7.1	8.4	7.9	4.8	8.6
Wesu-Wundanyi	Rural												7	5	3	2.8	2.3	6.4	5.4	9.9	
OVERALL		**5.1**	**6.3**	**7.4**	**8.5**	**9.5**	**10.4**	**11.2**	**11.9**	**12.5**	**13**	**13.4**	**12.8**	**10.6**	**9.4**	**7.5**	**7.3**	**6.9**	**7.0**	**6.2**	**7.6**

***Unlike prior years, more emphasis was given in the inclusion of known positive pregnant mothers.**

Annex 5: A list of the 43 sites and their site-specific HIV prevalence (2011).

				With known positives		Without known positives	
No	**Province**	**Site**	**Location**	**Sample size**	**Prevalence (%)**	**Sample size**	**Prevalence (%)**
1	Coast	Bamba	Rural	273	1.5	271	1.5
2		Tiwi	Mixed	188	8.6	181	6.1
3		*Kilifi	Mixed	410	3.9	402	2.2
4		Mombasa	Urban	416	11.1	391	6.1
5		Wesu	Rural	40	2.6	39	2.6
6		Wundanyi	Rural	94	3.3	89	0.0
7	Nairobi	Dandora	Urban	415	9.4	402	6.5
8		*Baba dogo	Urban	375	13.9	395	8.8
9		Riruta	Urban	407	9.8	392	6.4
10		Jericho	Urban	413	8.5	410	8.1
11		Kariobangi	Urban	410	8.1	406	7.4
12		Dagoretti	Urban	174	4.6	171	2.9
13	Central	*Nyeri	Urban	390	5.1	385	3.4
14		Thika	Mixed	418	4.3	412	3.4
15		Njabini	Rural	315	6.7	311	5.8
16		Maragua	Rural	313	8.3	289	1.7
17	Nyanza	Kisumu PGH	Urban	415	15.5	410	15.1
18		Chulaimbo	Rural	264	25.9	252	22.6
19		Suba	Rural	238	30.3	203	20.7
20		Tabaka	Rural	315	19.7	312	19.2
21		Kisii	Urban	415	7.0	410	6.6
22	R. Valley	Nakuru	Urban	415	5.3	406	3.5
23		Fatima	Rural	239	2.9	237	2.5
24		Sirikwa	Mixed	256	7.8	255	7.5
25		Kajiado	Mixed	166	3.0	166	3.0
26		Kaplong	Rural	315	3.5	315	3.5
27		Kitale	Mixed	416	5.1	410	4.4
28		Lodwar	Urban	315	13.1	307	11.1
29		Maralal	Mixed	270	5.0	259	4.3
30		Mosoriot	Rural	259	3.5	254	2.0
31		Baringo	Mixed	315	4.1	308	2.3
32		Turbo	Mixed	314	4.5	307	2.6
33	Western	Kakamega	Mixed	413	5.6	413	5.6
34		Mbale	Rural	315	5.7	315	5.7
35		Mt. Elgon	Mixed	223	2.2	220	0.9
36		Busia	Urban	415	9.4	405	7.7

				With known positives		Without known positives	
No	**Province**	**Site**	**Location**	**Sample size**	**Prevalence (%)**	**Sample size**	**Prevalence (%)**
37		Teso	Rural	312	4.8	310	4.5
38	Eastern	*Kitui	Mixed	246	5.3	264	3.4
39		*Meru	Mixed	417	4.6	414	3.9
40		Karurumo	Rural	171	4.7	170	4.1
41		Mutomo	Rural	230	3.5	226	1.8
42		*Kangundo	Mixed	300	5.0	312	4.7
43	N. Eastern	Garissa	Mixed	417	1.4	417	1.4
	Pooled estimates	**(Mean)** **(Median)**			**(7.4)** **(5.1)**		**(5.7)** **(4.2)**

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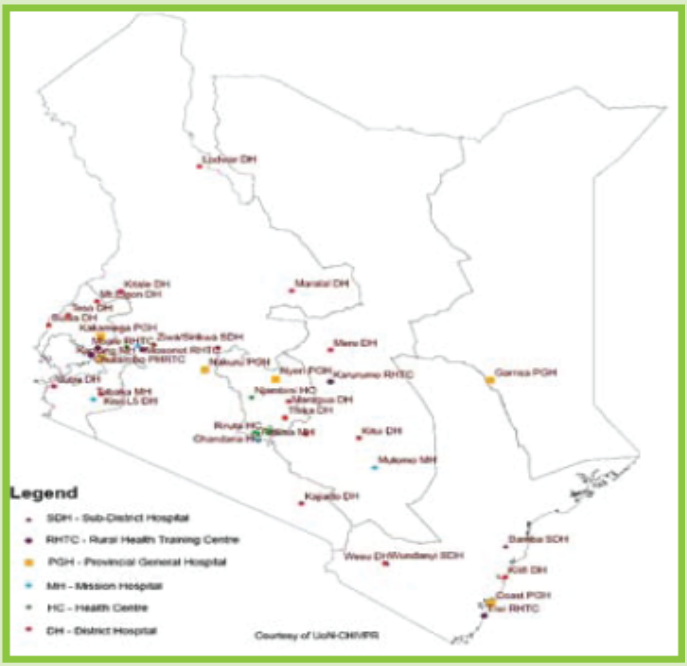
HIV SENTINEL SITES FOR 2012



Motto: We Do, We Document and We Disseminate =3D!

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