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Epidemiological profile of individuals diagnosed with HIV: results from the preliminary phase of case-based surveillance in Kenya

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Abstract

Understanding the characteristics of individuals who are newly diagnosed with HIV is critical to controlling the HIV epidemic. Characterizing this population can improve strategies to identify undiagnosed positives and assist in targeting the provision of HIV services to improve health outcomes. We describe the characteristics of newly diagnosed HIV cases in western Kenya from 124 health facilities. The study cohort cases were matched to prevent duplication and patients newly diagnosed between January and June 2015 were identified and descriptive analysis performed. Among 8664 newly identified HIV cases, during the pilot timeframe, 3.1% (n=265) had retested for HIV after initial diagnosis. Linkage to care was recorded for approximately half (45.3%, $n = 3930$) and 28.0% ($n = 2425$) had a CD4 count available during the pilot timeframe. The median baseline CD4 count was 332 cells/mL (IQR: 156–544). Among the newly diagnosed age 15 years or older with a CD4 test, 53.0% ($n = 1216$) were diagnosed late, including 32.9% ($n = 755$) who had advanced HIV at diagnosis. Factors associated with late diagnosis included being male and in an age group older than 34 years. In western Kenya, continued efforts are needed in the area of testing to enhance early HIV diagnosis and epidemic control.

Keywords

HIV; HIV diagnosis; HIV surveillance; descriptive epidemiology

Background

In Kenya, the human immunodeficiency virus (HIV) epidemic is generalized, with a concentration of high prevalence among key populations (Ministry of Health, National AIDS

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Control Council (NACC), 2016). Kenya's HIV prevalence in adults was estimated at 5.6% in 2012, with geographical variation ranging from a low of 0.4% in Wajir County to a high of 26% in Homa Bay County (NACC, 2016). In 2015, approximately 9.9 million HIV tests were conducted in Kenya, with those at high risk recommended to test quarterly; subsequently, over 77,000 cases of HIV were reported (NACC, 2016). It is important to understand the characteristics of those who are newly diagnosed with HIV in order to monitor the HIV epidemic and ultimately to reduce new infections, which is a strategic objective in Kenya (NACC, 2014). Characterization of newly diagnosed people living with HIV (PLHIV) is a key component of surveillance recommended by the World Health Organization (WHO), which can lead to better strategies to identify undiscovered positives and assist in targeting the provision of HIV services to improve health outcomes and achieve the 95–95-95 targets by 2030 (UNAIDS, 2014; WHO, 2015; WHO, UNAIDS, UNICEF, 2010; WHO, 2017a). It is also vital that those who are newly diagnosed are linked to care and treatment in a timely manner to maximize HIV prevention potential and treatment effectiveness (WHO, 2016).

As with other settings, there are concerns in Kenya with linkage to care (Obermeyer et al., 2013; Wachira et al., 2014), including late presentation to care or presentation with advanced HIV disease (NACC, 2016; Kwobah et al., 2015; Ng'ang'a et al., 2014) due to delayed diagnosis (Kwobah et al., 2015; Van der Kop et al., 2016). Initiation of care with advanced HIV leads to impaired immune recovery and reduced life expectancy (Johnson et al., 2013; Kwobah et al., 2015; Siika et al., 2008).

The Kenya Ministry of Health (MOH) plans to strengthen routine HIV surveillance by moving from aggregate reporting of persons diagnosed with HIV to a case-based surveillance (CBS) system. Case-based surveillance data are reported longitudinally at the individual level, facilitating case matching, de-duplication and updating of cases, leading to more accurate and informative data on the HIV epidemic which will enhance epidemic control (WHO, 2017a). In 2015, a pilot was performed in western Kenya to gather information on the feasibility of CBS implementation (NASCOP, 2017). This pilot collected a variety of data elements on new HIV diagnoses, which were used to describe the epidemiological characteristics of individuals at HIV diagnosis in two high burden counties of western Kenya.

Methods

During the CBS pilot, data on HIV cases were abstracted retrospectively by trained surveillance officers from 124 purposively selected health facilities from three sub-counties each in Kisumu and Siaya counties, representing 35% of the total facilities offering HIV services within those counties. Facilities were selected to ensure variation in size (hospital, health center, dispensary), services offered (HIV testing, treatment, mother and child care), supporting implementing partners and ownership (government, private, faith-based). Data were abstracted between July 2015 and January 2016, from standard paper-based medical records, laboratory records and registers and entered into a standardized HIV case report database on Android-based tablets. The data were then transmitted in real-time to a cloud-based SQL server hosted on the Amazon™ cloud computing service via a dedicated virtual

private network. Since data contained personally identifiable information (PII), they were encrypted before transmission. Data covered testing and clinical events, which occurred from January 2015 through the end of the data collection 20 January 2016. Key variables required for a case to be reported into the system included: reporting facility, patient first and last names, date of birth or age at HIV diagnosis, sex and date of diagnosis.

Matching and de-duplication of cases were performed using a probabilistic matching algorithm (Waruru et al., 2018). Variables used were Soundex of first name (a phonetic algorithm for indexing names by sound as the way they are pronounced in English), secondary double metaphone of the middle name (where the middle name was available), secondary double metaphone of last name, the first character of sex at birth, and year of birth. Cases that were found to be a match were combined to form a single case record.

For this analysis, the dataset included persons reported to be newly diagnosed which we defined as those with HIV diagnosis, either through rapid tests or early infant diagnosis, in the months of January through June 2015. Their associated characteristics and subsequent clinical events (e.g., date of entry into HIV care, CD4 test results, clinical staging) through the end of the observation period were examined. Data were analyzed using Stata version 14.2 (StataCorp, College Station, Texas USA). Participant characteristics were stratified by sub-county for representativeness and presented by frequency and percentage for categorical variables, and median and interquartile range (IQR) for continuous variables. A one sample proportion T-test was used to determine whether the proportion of cases who started care in the pilot had a p-value = 0.5, as it would be equal to those not entering care.

The consensus definition (Antinori et al., 2011) was used to define late presentation in adults (15+ years of age) (1) presenting for care with a CD4 count below 350 cells/mL or (2) presenting with an AIDS-defining illness, regardless of the CD4 cell count, while presentation with advanced HIV disease was defined as (1) CD4 count below 200 cells/mL or (2) presenting with an AIDS-defining illness, regardless of the CD4 cell count (Antinori et al., 2011; WHO, 2017b). AIDS-defining illness was limited by the data available in the pilot, and therefore included only TB diagnosis and/or WHO stages 3 or 4 at presentation to care. In multivariable analysis, cases were excluded if any of the independent variables had missing values. Bivariate logistic regression analysis was used to determine the association between participant characteristics and late presentation at HIV diagnosis. Variables with a p-value of < 0.1 were included in the multivariable logistic regression model. The final model was selected with manual backward elimination of non-significant variables. A p-value < 0.05 was considered to be statistically significant. Associations were reported by the use of unadjusted and adjusted odds ratios (OR) with their respective 95% confidence intervals (CIs).

Retesting, in which both initial and subsequent tests of persons diagnosed as HIV positive occurred during the pilot, was assessed. Retesting may be either patient-initiated (when a patient presented to a facility for testing claiming an unknown HIV status though their previous diagnosis had been captured in the surveillance system) or provider-initiated (when a patient transfers between facilities or departments, the new site may test to confirm the HIV status), although we were unable to determine how it was initiated from the data.

Ethical approval was obtained from the Kenya Medical Research Institute and United States Centers for Disease Control and Prevention. Access to data used in these analyses was password protected and all study coordinators, data abstractors and analysts signed a confidentiality form.

Results

During the CBS pilot, data were collected on 12,260 children and adult cases. One hundred and three records were excluded before matching and de-duplication due to missing date of HIV diagnosis and date of birth. Out of the remaining 12,157 records, 11,536 unique cases were retained after matching and de-duplication. Of those, 8664 (75.1%) were newly diagnosed with HIV between 1 January through 30 June 2015. The latest possible follow-up date was 20 January 2016, with the median follow-up time for this cohort of 5 months (IQR: 4–6).

Among the 8664 newly identified HIV cases, 64.2% (n = 5560) were female, with the female to male ratio of 1.9:1 for those 15 years and older (adults) and 1.1:1 for those under 15 years of age (children). One-third of cases (29.7%, n = 2569) were diagnosed in facilities located in Kisumu East sub-county. The median age at the time of diagnosis was 30.0 years (IQR: 24–37) and the 25–29 year age group accounted for 20.7% (n = 1795) of newly diagnosed cases. Overall, only 8.1% (n = 703) of cases were among children under the age of 15 years, although in sub-county Rarieda, the proportion was slightly higher at 11.9% (n = 134) (Table 1). The most common diagnosing facility type was health centers with 38.8% (n = 3364) of cases, although this varied by sub-county; in Seme (51.5%, n = 440) and Siaya (54.2%, n = 737) the majority of cases were diagnosed at dispensaries and in Kisumu West (45.2%, n = 668) at hospitals. Among the 3961 with information on the entry point, which is noted when entering HIV care, the most common entry points for HIV diagnosis were voluntary counseling and testing (VCT) within the facility (40.6%, n = 1593) followed by the outpatient departments (OPD) (36.2%, n = 1422).

Between January 2015 and the end of data collection on 20 January 2016, we detected 3.1% (n = 265) of cases for whom retesting occurred. Retesting of newly diagnosed cases was found more often among female cases (76.6%, n = 203), of whom less than a quarter were pregnant (10.3%, n = 21). Among cases retesting, 8.3% (n = 22) had already started care at the first facility before being retested at a subsequent facility. Approximately a quarter (26.4%, n = 70) of cases who retested started care after retesting. Seme sub-county had a higher amount of retesting occur within the same facility as compared with other sub-counties, with 2.9% (n = 25) of cases being retested in contrast to Kisumu East sub-county of 0.9% (n = 24). Gem sub-county had a higher amount of retesting occurring overall, with 4.1% (n = 52) of cases being retested during the pilot timeframe in contrast with Kisumu East sub-county overall retesting of 1.9% (n = 50).

Approximately half (45.4%, n = 3930) of those newly diagnosed in our cohort had documented linkage to HIV care at one of the pilot facilities during the months of observation. The majority (96.6%, n = 3797) of those linked to care were enrolled at the same facility as testing occurred. There was no significant difference in proportions between

those cases who started care in the pilot and those not entering care ($p = 0.258$). For more than half (65.9%, $n = 2589$) of all cases enrolled in care, the date of enrollment was the same day as diagnosis, with the median time of linkage to care being zero days (IQR: 0–2). According to the 2014 Kenya ART guidelines [18], which were being utilized during the pilot time period, all those aged 10 years and below and those above 10 years with a CD4 count ≤500 or WHO stage 3 or 4 are eligible for ART, 57.9% ($n = 2275$) of those newly diagnosed and entering care were eligible for ART.

Of those who were newly diagnosed, 28.0% ($n = 2425$) had a baseline CD4 count result available. The median baseline CD4 count was 332 cells/mL (IQR: 156–544). Those newly diagnosed in Kisumu East sub-county were more likely to have had a CD4 count available (37.6%, $n = 966$), while patients in Seme sub-county were less likely to have a CD4 count documented (18.0%, $n = 154$). Of those who enrolled in care the same day as diagnosis, 56.0% ($n = 1415$) had a CD4 count result, with the median baseline CD4 count of 316 cells/mL (IQR: 142, 511). Among adults newly diagnosed with a CD4 count or AIDS-defining illness, 53.0% ($n = 1216$) were classified as late presentation, including 32.9% ($n = 755$) who were classified as diagnosed at advanced HIV disease. Only 0.9% ($n = 35$) of those linked to care had a viral load result available prior to the end of data collection for the pilot, as the viral load is performed six months after ART initiation (NASCOP, 2014a), most would occur outside the pilot.

Late presentation to care at HIV diagnosis (Table 2) was higher in: men (62.6%, aOR: 1.7, 95% CI: 1.42–2.05) compared to women; in age groups 35–44 years (64.6%, aOR: 2.68, 95% CI: 2.00–3.59), 45–54 years (62.7%, aOR: 2.54, 95% CI: 1.78–3.63) and 55+ years (75.23%, aOR: 3.94, 95% CI: 2.38–6.53) compared to age group 15–24 years; and in Gem sub-county (64.5%, aOR: 2.00, 95% CI: 1.44–2.79) in comparison to Kisumu West sub-county.

Discussion

Using a longitudinal case-based surveillance platform to follow individual PLHIV from diagnosis into HIV care, we were able to gain insight on individual and system-wide characteristics which can be used to focus and improve service delivery and patient care. By linking across clinical events, these analyses exemplify some of the advantages of CBS as compared to aggregate reporting. CBS begins monitoring cases at testing, whereas patient-monitoring systems begin once the patient enters care. HIV testing rates are very high in western Kenya, however, aggregate data are based on the number of tests completed and not a number of individuals tested, as the data are not de-duplicated, CBS allows for de-duplication. CBS provides a valuable understanding of retesting, late presentation to care, and linkage to care, as well as providing characteristics of the positives identified.

Previous studies show that the proportion of women diagnosed with HIV in Kenya is higher than in men (NACC, 2016; NACC, 2014; NASCOP, 2014b), which is consistent with our results which detected more newly diagnosed cases among women. As women are also more likely to be retested after initial HIV diagnosis, CBS is important as it can provide more accurate data on the number of unique new diagnoses among women than aggregate

reporting. We did not identify retesting to be specifically related to pregnancy, as less than 11% of women who retested were pregnant. Other studies show that repeat testing for those already diagnosed with HIV has been identified as an issue as some patients question the accuracy of test results (Wringe et al., 2017), or simply wish additional verification. It is important to understand why retesting is occurring, as approximately 8% of cases retesting had already started care at the first facility before being retested at a different facility, which can occur if a patient transfers to another facility without disclosing it to either facility. While we identified only three percent of cases overall having been retested during the pilot timeframe, it is likely to be higher if the remaining facilities in the counties were included in CBS; additionally, some of our newly identified cases could have tested positive prior to the pilot. Retesting of cases is an issue when assessing the date of HIV diagnosis unless a national CBS system is implemented allowing de-duplication, as the date of diagnosis should be the date of initial diagnosis in order to accurately assess time to linkage to care and inform back-calculation of incidence from newly diagnosed cases.

Although the data show that half of all cases that enrolled in care did so with a date of enrollment the same date as diagnosis, the CD4 cell count data show that many of these cases were classified at a late stage of HIV disease. This shows that people are not testing early enough and attention is needed to address this.

Aggregate reporting systems are based on the assumption that people link to care within the same facility. These data confirm that a large proportion of cases do not link to care in the ensuing months at the same diagnosing facility, as less than half of newly diagnosed were linked to care at a pilot facility during the pilot timeframe, with a median follow-up time of five months. Given that we believe linkage rates overall to be well above 50%, as in 2015 ART coverage in Kisumu County was 58.1% and in Siaya County was 54.3% (NACC, 2016), this affirms that people may enter care and treatment at another facility (where they may likely be retested), and the need to link patient records across facilities.

Approximately 40% of those who were linked to care did not have a baseline CD4 test available during the study timeframe. This could be a result of data collection issues, as laboratory results are not consistently noted in a standard place in the medical record (NASCOP, 2017), additionally infrastructure issues where noted at this time (i.e., power outages and reagent shortages) which would affect the ability to perform laboratory testing (Measurement and Surveillance of HIV Epidemics Consortium, 2016). Analysis of the pilot case-based surveillance data in western Kenya revealed that advanced HIV at diagnosis or late diagnosis continues to be an issue, which is consistent with previous studies (Kwobah et al., 2015; Ng'ang'a et al., 2014; Obermeyer et al., 2013; Wachira et al., 2014; WHO, 2016). Delayed diagnosis has a major impact on morbidity, mortality and on continued disease transmission (Chadborn, Delpech, Sabin, Sinka, & Evans, 2006; Chaisson, Keruly, & Moore, 2000; Dybul et al., 2002; Mocroft et al., 2013; Sabin et al., 2004; WHO, UNAIDS, UNICEF, 2010). Late presentation to care for males in Africa has been found in previous studies (Diero, Shaffer, & Kimaiyo, 2006; Drain, Losina, & Parker, 2013; Geng, Hunt, & Diero, 2011; Kanters, Nansubuga, & Mwehire, 2013; Kigozi, Dobkin, & Martin, 2009; Siika et al., 2008), which is consistent with our findings. As delayed diagnosis was more common

in males and those aged 35–54 years, targeting testing for these groups should occur to promote earlier diagnosis and health care systems should address barriers in access to care.

Limitations of the pilot include the relatively short assessment period, as the median follow-up time was five months; therefore, linkage to care, clinical tests and retesting could have occurred outside of the timeframe, which would underrepresent the actual rates. As well, this short time frame precluded the availability of viral load testing and death data, which could have further shed light on the patient status on ART. Data are only representative of a portion of the facilities in these six sub-counties and newly diagnosed cases may have accessed care in or transferred to other facilities not part of the pilot; inclusion of all facilities would have increased the proportion linked to care. These data are supposed to represent those newly diagnosed, although it may also include those previously diagnosed who came during the pilot timeframe to seek care and were retested. Additionally, newly diagnosed persons are not assigned unique identifiers (a comprehensive care clinic number) until they receive care, and the current unique identifier is facility based, making matching and deduplication of cases more difficult, hence some repeat testers may have been missed. However, in the absence of unique identifiers, we utilized Jaro-Winkler score-based persons matching algorithm to match and de-duplicate records (Waruru et al., 2018). Limitations of the pilot system were data abstraction occurring six months after initial entry at testing and care facilities, which limits the public health response, and that data abstraction from paper records is resource intensive.

Several settings outside of sub-Saharan Africa have demonstrated the ability of CBS to systematically capture routinely collected health data to describe and monitor the HIV epidemic (Centers for Disease Control and Prevention, 2013; European Centre for Disease Prevention and Control, 2016; Supervie, Ndawinz, Lodi, & Costa-gliola, 2014; WHO, 2017a) and this pilot shows the benefits for a national CBS system in Kenya. Guidelines were developed in 2018 for a phased implementation of a passive CBS system in Kenya, which includes obtaining data electronically from patient-monitoring and service-delivery systems to expedite the process and privacy, security and confidentiality of data systems to protect individual level HIV data, in particular data of vulnerable key populations, as the system includes name for matching cases since unique patient identifiers remain an issue. In western Kenya, continued efforts are needed to create an environment that encourages people to understand risks for HIV, and the benefits of treatment, in order to promote diagnosis of HIV infection as early as possible. Promotion of early diagnosis and referral to HIV care will likely have the greatest impact on HIV-related health status and secondary transmission. The implementation of “test and treat” in Kenya (NASCOP, 2016) along with the updated HIV surveillance strategy launched in 2018 should help ensure newly identified HIV patients start treatment promptly and include partner notification and testing which will assist in identifying additional cases.

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Table 1.

Characteristics of persons newly diagnosed with HIV from January 1 through 30 June 2015, by sub-county.

Characteristics	Total	Kisumu East	Kisumu West	Seme	Gem	Rarieda	Siaya
Number of sites	122	16	19	23	24	21	19
Total	8664	2569 (29.7)	1477 (17.0)	855 (9.9)	1282 (14.8)	1122 (13.0)	1359 (15.7)
Sex							
Female	5560 (64.2)	1611 (62.7)	917 (62.1)	578 (67.6)	869 (67.8)	750 (66.8)	835 (61.4)
Male	3104 (35.8)	958 (37.3)	560 (37.9)	277 (32.4)	413 (32.2)	372 (33.2)	524 (38.6)
Age at diagnosis (yrs)							
<2 years	128 (1.5)	25 (1.0)	21 (1.4)	12 (1.4)	23 (1.8)	17 (1.5)	30 (2.2)
2–4 years	236 (2.7)	56 (2.2)	46 (3.1)	11 (1.3)	33 (2.6)	53 (4.7)	37 (2.7)
5–9 years	186 (2.1)	40 (1.6)	32 (2.2)	16 (1.9)	28 (2.2)	39 (3.5)	31 (2.3)
10–14 years	153 (1.8)	49 (1.9)	33 (2.2)	11 (1.3)	20 (1.6)	25 (2.2)	15 (1.1)
15–24 years	2066 (23.9)	573 (22.3)	354 (24.0)	232 (27.1)	311 (24.3)	287 (25.6)	309 (22.7)
25–34 years	3251 (37.5)	1040 (40.5)	544 (36.8)	332 (38.8)	458 (35.7)	389 (34.7)	488 (35.9)
35–44 years	1609 (18.6)	509 (19.8)	275 (18.6)	134 (15.7)	241 (18.8)	194 (17.3)	256 (18.8)
45–54 years	686 (7.9)	193 (7.5)	126 (8.5)	70 (8.2)	96 (7.5)	69 (6.2)	132 (9.7)
55+years	349 (4.0)	84 (3.3)	46 (3.1)	37 (4.3)	72 (5.6)	49 (4.4)	61 (4.5)
Diagnosing facility type							
Dispensary	2850 (32.9)	376 (14.6)	546 (37.0)	440 (51.5)	414 (32.3)	337 (30.0)	737 (54.2)
Health Center	3364 (38.8)	1444 (56.2)	263 (17.8)	153 (17.9)	648 (50.5)	645 (57.5)	211 (15.5)
Hospital	2450 (28.3)	749 (29.2)	668 (45.2)	262 (30.6)	220 (17.2)	140 (12.5)	411 (30.2)
Retesting rates							
Retest – outside facility	137 (1.6)	26 (1.0)	26 (1.8)	8 (0.9)	34 (2.7)	21 (1.9)	22 (1.6)
Retest – internal facility	128 (1.5)	24 (0.9)	30 (2.0)	25 (2.9)	18 (1.4)	11 (1.0)	20 (1.5)
No retest	8399 (96.9)	2519 (98.1)	1421 (96.2)	822 (96.1)	1230 (95.9)	1090 (97.1)	1317 (96.9)
Entry point at facility[a]							
VCT	1593 (40.6)	851 (66.3)	260 (42.6)	104 (34.3)	71 (11.9)	116 (23.0)	191 (30.4)
IPD-Adult	58 (1.5)	15 (1.2)	16 (2.6)	1 (0.3)	11 (1.9)	2 (0.4)	13 (2.1)
IPD-Child	4 (0.1)	1 (0.1)	1 (0.2)	0 (0.0)	1 (0.2)	0 (0.0)	1 (0.2)
MCH-Child	38 (1.0)	6 (0.5)	8(1.3)	1 (0.3)	11 (1.8)	6(1.2)	6(1.0)

Characteristics	Total	Kisumu East	Kisumu West	Seme	Gem	Rarieda	Siaya
OPD	1422 (36.2)	226 (17.6)	168 (27.5)	77 (25.4)	406 (68.1)	259 (51.4)	286 (45.5)
PMTCT	457 (11.6)	115 (9.0)	91 (14.9)	52 (17.2)	75 (12.6)	45 (8.9)	79 (12.6)
TB Clinic	24 (0.6)	6 (0.5)	5 (0.8)	6 (2.0)	2 (0.3)	4 (0.8)	1 (0.2)
Other	331 (8.4)	64 (5.0)	62 (10.2)	62 (20.5)	19 (3.2)	72 (14.3)	52 (8.3)
First CD4 cell count after diagnosis							
No CD4 test recorded 6239 (72.0)	1603 (62.4)	1119 (75.8)	701 (82.0)	975 (76.1)	789 (70.3)	1052 (77.4)	
<200	774 (8.9)	317 (12.3)	88 (6.0)	51 (6.0)	120 (9.4)	105 (9.4)	93 (6.8)
200–349	478 (5.5)	178 (6.9)	71 (4.8)	26 (3.0)	74 (5.8)	61 (5.4)	68 (5.0)
350–499	475 (5.5)	191 (7.4)	64 (4.3)	34 (4.0)	54 (4.2)	66 (5.9)	66 (4.9)
>500	698 (8.1)	280 (10.9)	135 (9.1)	43 (5.0)	59 (4.6)	101 (9.0)	80 (5.9)
Median (IQR)	332 (156–544)	335 (150–548)	387 (200–634)	345 (145–520)	260 (121–454)	350 (163–556)	320 (158–514)
Eligible for ART [b]							
No	638 (21.9)	255 (24.0)	127 (28.0)	39 (20.9)	54 (13.9)	89 (20.7)	74 (18.8)
Yes	2275 (78.1)	806 (76.0)	327 (72.0)	148 (79.1)	334 (86.1)	341 (79.3)	319 (81.2)

[a]The entry point is defined as the source of HIV diagnosis and the location of the HIV care referral for those entering care (Note: three adults had missing entry points and entry point was not collected for children in care).

[b]ART eligibility based on 2014 Kenya ART Guidelines which follows 2013 WHO ART guidelines with all those aged 10 years and below on ART and those above 10 years initiated with CD4 count ≤500 (NASCOP, 2014a).

Table 2.

Factors associated with late presentation among adults newly diagnosed with HIV from January 1 through 30 June 2015.

Characteristic (*N* =2295)	Late presentation *n* (%)	uOR[d]	95% CI	*p*-Value	aOR[e]	95% CI	*p*-Value
Total	1216 (53.0)						
Sex				<0.001			
Female	650 (46.7)	*ref.*					
Male	566 (62.6)	1.91	1.61–2.27	<0.001	1.70	1.42–2.05	<0.001
Age at diagnosis (yrs)				<0.001			
15–24	160 (35.4)	*ref.*					
25–34	495 (50.2)	1.84	1.46–2.31	<0.001	1.65	1.29–2.11	<0.001
35–44	338 (64.6)	3.33	2.56–4.34	<0.001	2.68	2.00–3.59	<0.001
45–54	141 (62.7)	3.06	2.20–4.27	<0.001	2.54	1.78–3.63	<0.001
55+	82 (75.2)	5.54	3.44–8.92	<0.001	3.94	2.38–6.53	<0.001
Diagnosing facility type				0.424			
Dispensary	333 (51.2)	*ref.*					
Health Center	617 (54.3)	1.13	0.93–1.37	0.209			
Hospital	266 (52.3)	1.04	0.83–1.31	0.728			
Marital Status[a]				<0.001			
Single	193 (47.4)	*ref.*					
Married/Cohabiting	757 (51.4)	1.17	0.94–1.46	0.156	0.82	0.64–1.04	0.1
Divorced/Widowed/Separated	254 (63.7)	1.94	1.47–2.57	<0.001	1.23	0.90–1.69	0.194
Discordant Couple[b]				0.105			
No	511 (55.5)	1.30	0.92–1.83	0.136			
Unknown	463 (51.2)	1.09	0.77–1.54	0.615			
Yes	74 (49.0)	*ref.*					
Linked to Care[c]				0.204			
Different day than diagnosis	423 (51.3)	*ref.*					
Same day as diagnosis	785 (54.1)	1.12	0.94–1.32	0.204			
Sub-county				<0.001			
Kisumu East	482 (52.5)	1.36	1.06–1.75	0.015	1.30	1.01–1.69	0.046

Characteristic (*N* =2295)	Late presentation *n* (%)	uOR[d]	95% CI	*p*-Value	aOR[e]	95% CI	*p*-Value
Kisumu West	153 (44.9)	*ref.*					
Seme	74 (51.0)	1.28	0.87–1.89	0.278	1.25	0.83–1.87	0.284
Gem	191 (64.5)	2.24	1.62–3.08	<0.001	2.00	1.44–2.79	<0.001
Rarieda	163 (52.8)	1.37	1.01 –1.87	0.045	1.29	0.93–1.78	0.125
Siaya	153 (53.3)	1.40	1.02–1.92	0.035	1.24	0.89–1.72	0.206

[a] *n* = 1204 (Note: 12 had missing data).

[b] *n* = 1048 (Note: 168 had missing data).

[c] *n* = 1208 (Note: 8 had missing data).

[d] Unadjusted odds ratio (uOR) *N*=2295.

[e] Adjusted odds ratio (aOR) *N*= 2279.