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Impacts of Recent Infection Testing Integration into HIV Surveillance in Ekiti State, South West Nigeria: A Retrospective Cross Sectional Study

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Abstract

Background: Timely detection of recent HIV infections is critical in achieving the HIV epidemic. The aim of this study was to evaluate the effects of integrating the Recent Infection Testing Algorithm in HIV surveillance in Ekiti State, South West Nigeria. **Method:** Data from the Nigeria Medical Records System (NMRS)/National Data Repository (NDR) and Index Testing (IT) Services data capturing tools were abstracted for a retrospective cross-sectional study of 719 newly diagnosed HIV-positive cases who were screened for HIV incident infection using Asante rapid recency test kits between August 2020 and June 2022 at 5 selected recency testing health facilities. The venous blood (10 ml) of all the rapid Asante tested recent patients were collected into an EDTA tube and processed for viral load testing. The plasma level of HIV-1 RNA was quantified using the CAP/CTM and cobas 4800 platform at Obafemi Awolowo University Teaching Hospital PCR Laboratory Ife. Chi-square was used to characterize the recency status of the patients. A measure of the association was done using Chi-square, while the p-value of 0.05 was considered statistically significant. **Results:** The median age of the participants was 39 years. The result from the study showed that of the total number of 719 new cases of diagnosed HIV-positive, 626 of them were screened for rapid Test for Recency infection (RTRI) (87%). Overall, we found that 1.8% (11/626) of clients were classified as recent. The investigation also showed that from the index cases of the 11 confirmed recent infections, a total number of 125 additional positive cases were found. **Conclusion:** This result indicated a rise in the number of cases discovered in the State. Therefore, incorporating recency testing within regular HIV testing programs becomes essential in order to prioritize

clients for index testing and provide useful information on transmission clusters.

Keywords

Impacts, Recent Testing, HIV Surveillance

1. Study Background

According to a UNAIDS report, there are approximately 37.7 million people worldwide living with HIV, of which an estimated 1.5 million individuals have acquired new HIV infections [1]. In the same report, 36 million were adults and 1.7 million were children aged 0 - 14 years, while more than half (53%) were women and girls. "HIV incidence" refers to the estimated number of people who newly acquired HIV during a given period of time [1]. Globally, Nigeria was ranked third among countries with the highest burden of Human Immuno-Deficiency Virus (HIV) infection [2]. As of 2021/2022, Nigeria's national prevalence of HIV remains at 1.4% among adults aged 15 - 49 years [3], while HIV is more prevalent among women aged 15 - 49 years than men. Recently, the 2019 Nigeria National HIV/AIDS Indicator and Impact Survey found that 1.9 million people are living with HIV and AIDS in Nigeria as of 2018 [4]. UNAIDS has set global goals for 95% of all people living with HIV (PLHIV) to be diagnosed, 95% of these to be initiated and retained on antiretroviral therapy (ART), and 95% of these to be virally suppressed (95-95-95) by 2030 [5]. With the introduction of innovative laboratory technology, immediate detection of recent HIV infection is now possible within minutes [6]. An accurate understanding of the HIV epidemic in Ekiti State through recency testing is critical to implementing targeted public health interventions to break the HIV transmission chain as well as describing concurrent transmission trends. Results from the study conducted in the Dehong prefecture of Yunnan province revealed that comparing different RITA outcomes increases the accuracy in classifying recent HIV infections and major drivers of the epidemic as well as the measurable interventions [7]. Evidence has implicated many factors such as natural variability in individual immune responses (specifically the elite control of HIV or natural viral suppression), variability in biomarker progression for different HIV-1 subtypes, the types of specimens collected and storage methods, advanced HIV disease, and treatment with antiretroviral therapy (ART) or use of pre-exposure prophylaxis (PrEP) to be responsible for misclassification of longstanding infections as recent, thus increasing the false recency rate [8] [9] [10]. According to the previous study, married people were less likely to be recently infected than unmarried people (aOR = 0.60, 95% CI: 0.40, 0.91); people aged 25 - 49 years and older were less likely to be recently infected than people aged 15 - 24 years [7]. The epidemiological study revealed that quantitative analysis of geographical areas by comparing recent and long-term HIV infections allows accurate identi-

fication of hot-spot areas where new infections are expanding, which can be used as a potent framework to guide targeted interventions and curb the spread of the HIV epidemic [11]. Evidence has shown that using both recent infection testing algorithm (RITA) assays and viral load (VL) testing is a game changer in identifying people who have been infected with HIV in the last 12 months [12]. A study conducted by [13] in Kenya and Zimbabwe showed that 2.3% of HIV-positive pregnant women, 10.5% of female sex workers, and 8.6% (46) were classified as recent. The results from the Akwa Ibom AIDS Indicator Survey (AKAIS), Nigeria showed that the recent HIV infection rate among the participants was 3.0%; the respective HIV incidence rate of females (0.41%) and males (0.42) was the same [14]. The result from the study conducted [15] revealed that partner notification services were very effective in improving yield in routine HIV testing. The aim of this study was to evaluate the effects of integrating the Recent Infection Testing Algorithm into HIV surveillance in Ekiti State, South West Nigeria.

2. Study Rationale

The rationale behind this study is that there is a paucity of research on the identification, characterization, and monitoring of new HIV infections using routine integrated HIV recency assays to break the chain of transmission in Ekiti, South West Nigeria. In order to understand whether there is an upsurge in the epidemic or if the increase is a result of detecting previously undiagnosed cases, integration of recent infection testing into the routine HIV surveillance system becomes imperative. A study revealed that the integration of Recent Infection Testing Algorithms (RITAs) in routine surveillance systems would improve HIV incidence estimation as well as contribute significantly to the identification of populations with a high risk of acquiring HIV [16]. In the same epidemiological study, rapid identification of newly infected people has a great impact on breaking the HIV transmission chain and ending epidemics.

3. Methodology

The study involved 719 newly diagnosed HIV-positive cases who were screened for HIV incident infection using Asante rapid recency test kits between August 2020 and June 2022 from 5 selected health facilities (Ekiti State University Teaching Hospital, Ado, Federal Teaching Hospital Ido, State Specialist Hospital Ikere, State Specialist Hospital Ikole and General Hospital Omuo). Data from Nigeria Medical Records System (NMRS)/National Data Repository (NDR) and Index Testing (IT) Services data capturing tools were abstracted for a retrospective cross-sectional study. These secondary data, which included recent infection testing algorithms (RITAs) and IT services response interpretation findings, were obtained from routine recency surveillance assay and IT services performed in Ekiti State. The venous blood (10 ml) of all the Asante tested RTRI recent patients were collected into EDTA tube and processed for viral load testing. The plasma level of HIV-1 RNA was quantified using the CAP/CTM and

cobas 4800 platform at Obafemi Awolowo University Teaching Hospital PCR Laboratory, Ife. The viral load results <1000 copies/mL were categorized as "long-term" infections, while VL ≥1000 copies/mL were classified as "recent" infections (that is, infections acquired within 12 months). The viral load results cut off of ≥1000 copies/ml was used to minimize potential misclassification of the RTRI assay, thereby excluding "false recent" results. The inclusion criteria for this study were clients who were 15 years old and above, those that received HIV-positive results for the first time between August 2020 and June 2022, ART naive as well as those that consented to the RTRI testing, while the exclusion criteria included clients that were less than 15 years old, those who opted out of RTRI testing, those with a documented history of HIV positive test results, those who have taken HIV medication (ART) for treatment before, those with inconclusive final recency interpretation due to viral load failed test results, and those who did not consent to the RTRI test. Chi-square was used to measure the association, while a p-value of 0.05 was considered statistically significant.

Classification of Recent HIV Infection Cases under Different Recency Assay Methods

Both Rapid Test for Recent Infection (RTRI) assay and viral load testing were used to classify recent HIV infection cases. While RTRI assay was determined using Rapid Asante test kits, viral load test results ≥1000 copies/ml were used to confirm the actual recent infection. Therefore, for the participant to be classified as a recent case, the RTRI test result shall be recent and the viral load assay result shall be ≥1000 copies/ml.

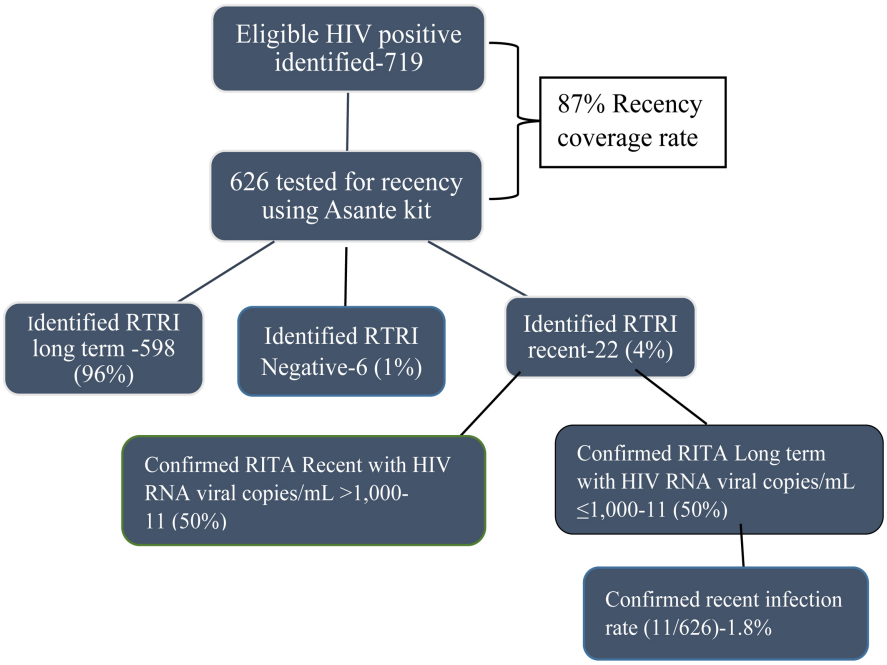

Figure 1. Study Flowchart showing the result of both Asante HIV Rapid Recency assay and viral load testing outcomes.

4. Results

4.1. Sociodemographic Characteristics

Out of the total number of 719 cases diagnosed HIV-positive for the first time, 626 cases were screened for recency, giving a recency coverage rate of 87.1% as shown in Figure 1. The results from Table 1 below, which showed the distribution of the participants (n = 626) revealed that the mean and median age (in years) of the participants sampled was 38.7 ± 11.3 and 39 respectively. The majority of the participants 583 (93.1%) were within the age bracket of 25 and above. It also showed that there were more female participants 348 (55.6%) than male participants 278 (44.4%). Most of participants 467 (74.6%) and 147 (23.5%) were mainly married and single respectively. The greater percentage of the participants 440 (70.6%) was employed, while a large number of the participants 306 (49.1%) and 177 (28.4%) had secondary and tertiary levels of education respectively.

Table 1. Sociodemographic characteristics.

	N = 626	
Mean	38.7	
Median	39.0	
Mode	40.0	
Std. Deviation	11.3	
Variables	**n**	**%**
Age group		
15 - 19	7	1.1
20 - 24	36	5.8
25+	583	93.1
Gender		
Male	278	44.4
Female	348	55.6
Civil Status		
Single	147	23.5
Married	467	74.6
Widowed	10	1.6
Divorced	1	0.2
Living with Partner	1	0.2
Educational Level		
Primary	82	13.2
Secondary	306	49.1
Tertiary	177	28.4
None	51	8.2

4.2. Identification of Recent Infection under Different Recency Assay Methods among the Participants

Prior to viral load testing, 22 (3.5%) of the total 626 newly diagnosed patients were rapidly identified as having recent HIV-1 infections using the Asante HIV-1 Rapid Kit, as shown in Table 2. Overall, 1.8% (11/626) of the participants were classified as recently infected within 12 months based on Asante Rapid Recency and viral load test results of ≥1000 copies/ml. Conversely, of the 22 participants who were labeled as recent based on the results of the RTRI test, 11 long-standing infections were incorrectly classified, giving a false recency rate (FRR) or recency misclassification rate of 50% (11/22).

However, out of the 626 participants tested for recency, 74.1% had never tested for HIV in their lives, while 89.1% of them had never tested for HIV in the last 12 months. Also, 100% of all the confirmed recently infected participants had never been exposed to HIV testing services both in their lifetime and in the last 12 months.

4.3. Distribution of Confirmed Recent Infection Cases by Participants' LGA of Residence

Figure 2 below revealed that all the confirmed participants with recent infections were residing in Ido Osi and Ado local Government Area. It also showed that the majority of the recent infection was predominant in Ado LGA (9) when compared with the number in Ido Osi LGA (2).

Table 2. Characterization of recent infection under different recency assay methods among the participants.

RTRI			RITA			RTRI & RITA		
N = 626			n = 22			N = 626, n = 11		
Variables	**n**	**(%)**	**Variables**	**n**	**%**	**Variables**	**n**	**%**
Long Term	598	95.5	Long Term	11	50.0	Long Term	11	1.8
Recent	22	3.5	Recent	11	50.0	Recent	11	1.8
Negative	6	1						
Ever tested negative for HIV			Ever tested negative for HIV			Ever tested negative for HIV		
Yes	162	25.3	Yes	3	13.6	Yes	0	0.0
No	464	74.1	No	19	86.4	No	11	100.0
Tested negative for HIV in the last 12 months			Tested negative for HIV in the last 12 months			Tested negative for HIV in the last 12 months		
Yes	68	10.9	Yes	9	40.9	Yes	0	0.0
No	558	89.1	No	13	59.1	No	11	100.0

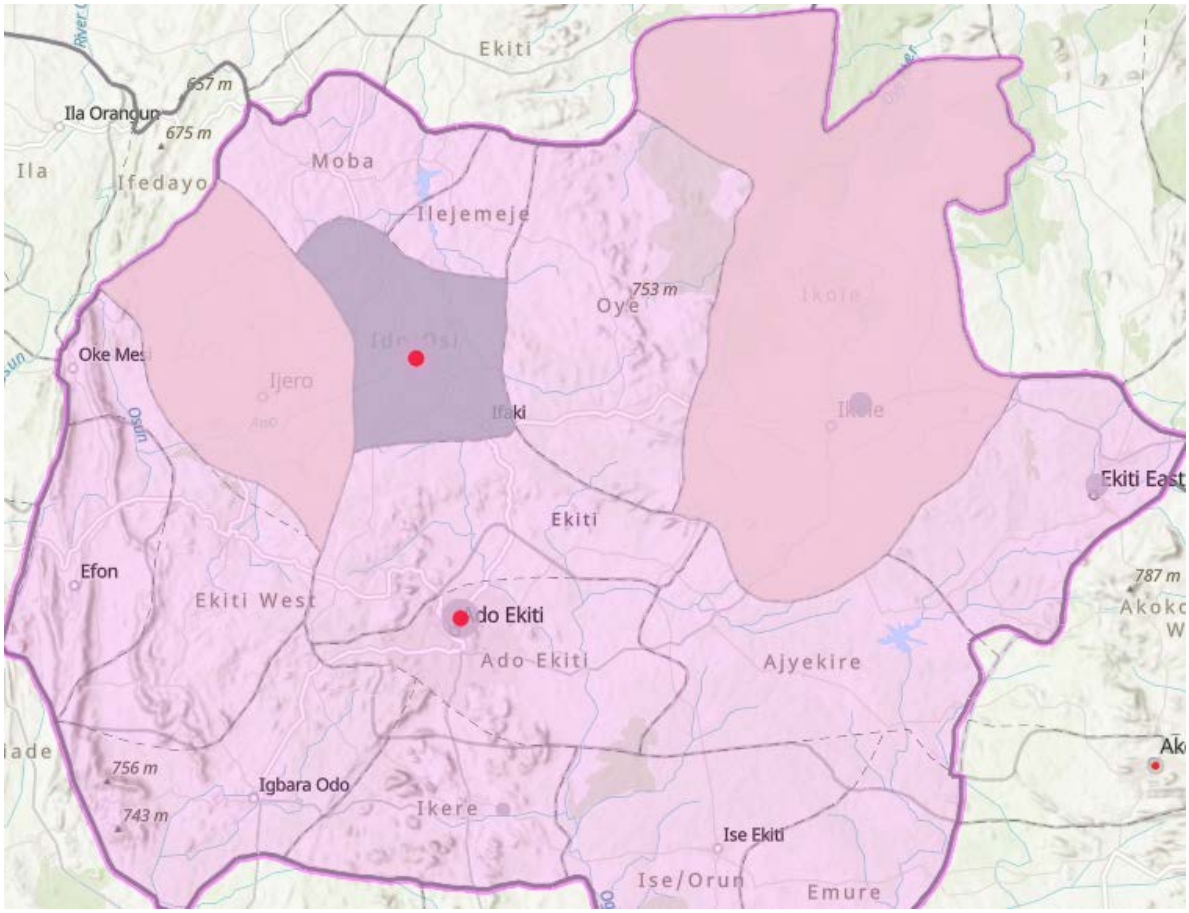

Figure 2. GIS Map showing the distribution of confirmed recent HIV infections by the participants' LGA of residence. Legend: ● RITA Recent; ● RITA Long-Term.

4.4. Partner Notification Outcome

The study showed that one index case elicited at most 2 partners resulting in an approximate elicitation rate of 1% - 2%. Of the 11 recently infected first generation participants, 23 partners were elicited. These elicited partners were contacted via standard WHO partner notification methods such as scripted calls and test messages. Others were reached using targeted house-to-house, event and workplace testing approaches. From the first generation cascade, 12 of the elicited partners were newly diagnosed HIV positive and the index testing cascade and chain of partner notification services continues to the nth generation when no more HIV positives were identified as shown in **Figure 3** below.

4.5. Association between Sociodemographic Variables and HIV Recent Infection

Findings from **Table 3** below revealed that across the respective age band and sex, the difference was statistically significant ($X^2 = 4.455$, df = 1, P = 0.0035**), and ($X^2 = 7.364$, df = 1, p = 0.007**). The null hypothesis was rejected; there was a significant relationship between the participant's age, sex and recent HIV infection.

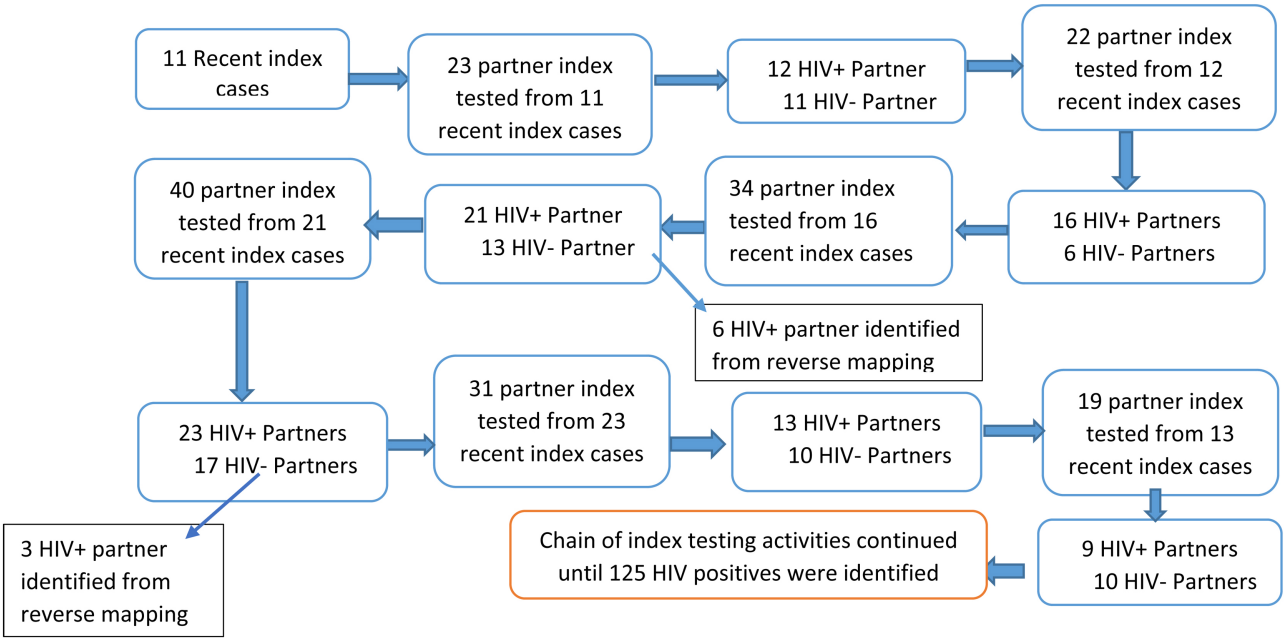

Figure 3. Study partner notification outcomes.

Table 3. Association between sociodemographic variables and the confirmed recent infection outcomes.

Variables	n	%	X2	df	P-Value
Age group					
20 - 24	2	18.2	4.455	1	0.035*
25+	9	81.8			
Gender					
Male	1	9.1	7.364	1	0.007*
Female	10	90.9			
Civil Status					
Single	4	36.4	0.818	1	0.366
Married	7	63.6			
Job Status					
Employed	7	63.6	0.818	1	0.366
Student	4	36.0			

5. Discussion

This study was conducted to evaluate the effects of integrating the Recent Infection Testing Algorithm in HIV surveillance in Ekiti State, South West Nigeria.

Findings from this study showed that there were more female participants (55.4%) than male participants (278, 44.4%). Most of the participants (467, or 74.6%) and 147, or 23.5%) were mainly married and single, respectively. A greater percentage of the participants (440, or 70.6%) were employed, while a large number of the participants (306, or 49.1%) and 177, or 28.4%) had second-

ary and tertiary levels of education, respectively.

In this study, we found that 1.8% of the participants were classified as recently infected with HIV, while 1.8% of the participants initially classified as recent with serological recency testing were reclassified as long-standing (long-term) infection with viral load assay. This result is in tandem with the outcome of the study which demonstrated that the use of both recent infection testing algorithm (RITA) assays and load (VL) testing is a game changer in identifying people whose infection occurred within the last 12 months [12]. The results from this study revealed that all the confirmed participants with recent infections were residing in Ido Osi and Ado local government areas. This outcome is in agreement with the study which stated that quantitative analysis of geographical areas by comparing recent and long-term HIV infections allows accurate identification of hot-spot areas where new infections are expanding, which can be used as a potent framework to guide targeted interventions and curb the spread of the epidemic [11]. Also, findings from this study revealed that the age group of 25 years and above (81%) had a high rate of recent HIV infection. This outcome is contrary to the study conducted by [7], which revealed that the age bands of 25 - 49 years and above were less likely to be recently infected than the age bracket of 15 - 24 years. Results from this study also showed that the HIV incident rate among females (90.9%) was higher than that of males (9.1%). This outcome is contrary to the study conducted by [14], which demonstrated that the respective HIV incidence rate of females (0.41%) and males (0.42) was the same. This may be related to higher health seeking behavior among women when compared to men. A large percentage of the participants with a high recency rate (63.6%) were married. This finding is different from the study which reported that married people were less likely to be recently infected than unmarried people [7].

This study also revealed that more cases of HIV positives were identified through partner notification services. This outcome is in line with the study which corroborated that partner notification services were very effective in improving yield in routine HIV testing [15].

6. Conclusion

It was discovered that incorporating recent infection testing into regular HIV surveillance services is essential for tracking the incidence of HIV, assessing the efficacy of implemented interventions, identifying high-risk populations, and locating geographic clusters where HIV transmission is still occurring. Application of index testing to the recently identified HIV cases contributed significantly to optimizing case findings within these localities. We also found that recency serological testing and viral load assay work best together to identify patients who have recently become HIV-positive.

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Limitation for the Study

There was no obvious limitation during the execution of this study.

Disclaimer

The products used for this research are commonly and predominantly used products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge.

Ethical Approval

Ethical clearance and approval (with approval number FETHI/ERC/22/234) were obtained from the Ethics & Research Committee of Federal Teaching Hospital Ido Ekiti, Southwest Nigeria.

Conflicts of Interest

The authors have declared that no competing interests exist.

References

[1] UNAIDS (2021, November) The Global HIV/AIDS Epidemic. https://www.hiv.gov/hiv-basics/overview/data-and-trends/global-statistics

[2] UNODC (2019) HIV and AIDS. https://www.unodc.org/

[3] Eshemokha, U. (2022, February 4) 2022 List of States with the Highest HIV Rate in Nigeria. Nigerian Health Blog. https://nimedhealth.com.ng/2019/11/16/2021-list-of-states-with-the-highest-hiv-rate-in-nigeria

[4] UNODC (2020, February 1) HIV and AIDS. https://www.unodc.org/

[5] UNAIDS (2016) Ending the AIDS Epidemic 2030—Global Statistics 2016. UNAIDS Fact Sheet 2016.

[6] Granade, T.C., Nguyen, S., Kuehl, D.S. and Parekh, B.S. (2013) Development of a Novel Rapid HIV Test for Simultaneous Detection of Recent or Long-Term HIV Type 1 Infection Using a Single Testing Device. *AIDS Research and Human Retroviruses*, **29**, 61-67. https://doi.org/10.1089/aid.2012.0121

[7] Zhu, Q., Wang, Y., Liu, J., Duan, X., Chen, M., Yang, J., Yang, T., Yang, S., Guan, P., Jiang, Y., Duan, S., Wang, J. and Jin, C. (2020) Identifying Major Drivers of Incident HIV Infection Using Recent Infection Testing Algorithms (RITAs) to Precisely Inform Targeted Prevention. *International Journal of Infectious Diseases*, **101**, 131-137. https://doi.org/10.1016/j.ijid.2020.09.1421

[8] Chaillon, A., Le Vu, S., Brunet, S., Gras, G., Bastides, F., Bernard, L., Meyer, L. and Barin, F. (2012) Decreased Specificity of an Assay for Recent Infection in HIV-1-Infected Patients on Highly Active Antiretroviral Treatment: Implications for Incidence Estimates. *Clinical and Vaccine Immunology: CVI*, **19**, 1248-1253.

https://doi.org/10.1128/CVI.00120-12

[9] Laeyendecker, O., Brookmeyer, R., Oliver, A.E., Mullis, C.E., Eaton, K.P., Mueller, A.C., Jacobson, L.P., Margolick, J.B., Brown, J., Rinaldo, C.R., Quinn, T.C., Eshleman, S.H. and Multicenter Aids Cohort Study Macs (2012) Factors Associated with Incorrect Identification of Recent HIV Infection Using the BED Capture Immunoassay. *AIDS Research and Human Retroviruses*, **28**, 816-822. https://doi.org/10.1089/aid.2011.0258

[10] Longosz, A.F., Serwadda, D., Nalugoda, F., Kigozi, G., Franco, V., Gray, R.H., Quinn, T.C., Eshleman, S.H. and Laeyendecker, O. (2014) Impact of HIV Subtype on Performance of the Limiting Antigen-Avidity Enzyme Immunoassay, the Bio-Rad Avidity Assay, and the BED Capture Immunoassay in Rakai, Uganda. *AIDS Research and Human Retroviruses*, **30**, 339-344. https://doi.org/10.1089/aid.2013.0169

[11] Zhu, Q., JiKe, C., Xu, C., Liang, S., Yu, G., Wang, J., Xiao, L., Liu, P., Chen, M., Guan, P., Liu, Z. and Jin, C. (2021) A New Strategy to Quantitatively Identify Hot-Spot Areas in Growth of New HIV Infections for Targeted Interventions. *Frontiers in Public Health*, **9**, Article ID: 680867. https://doi.org/10.3389/fpubh.2021.680867

[12] Kassanjee, R., Pilcher, C.D., Busch, M.P., Murphy, G., Facente, S.N., Keating, S.M., Mckinney, E., Marson, K., Price, M.A., Martin, J.N., Little, S.J., Hecht, F.M., Kallas, E.G. and Welte, A. (2016) Viral Load Criteria and Threshold Optimization to Improve HIV Incidence Assay Characteristics. *AIDS*, **30**, 2361-2371. https://doi.org/10.1097/QAD.0000000000001209

[13] Rice, B.D., Wit, M., Welty, S., Risher, K., Cowan, F.M., Murphy, G., Chabata, S.T., Waruiru, W., Magutshwa, S., Motoku, J., Kwaro, D., Ochieng, B., Reniers, G. and Rutherford, G. (2020) Can HIV Recent Infection Surveillance Help Us Better Understand Where Primary Prevention Efforts Should Be Targeted? Results of Three Pilots Integrating a Recent Infection Testing Algorithm into Routine Programme Activities in Kenya and Zimbabwe. *Journal of the International AIDS Society*, **23**, e25513. https://doi.org/10.1002/jia2.25513

[14] Negedu-Momoh, O.R., Balogun, O., Dafa, I., Etuk, A., Oladele, E.A., Adedokun, O., James, E., Pandey, S.R., Khamofu, H., Badru, T., Robinson, J., Mastro, T.D. and Torpey, K. (2021) Estimating HIV Incidence in the Akwa Ibom AIDS Indicator Survey (AKAIS), Nigeria Using the Limiting Antigen Avidity Recency Assay. *Journal of the International AIDS Society*, **24**, e25669. https://doi.org/10.1002/jia2.25669

[15] Welty, S., Motoku, J., Muriithi, C., Rice, B., de Wit, M., Ashanda, B., Waruiru, W., Mirjahangir, J., Kingwara, L., Bauer, R., Njoroge, D., Karimi, J., Njoroge, A. and Rutherford, G.W. (2020) Brief Report: Recent HIV Infection Surveillance in Routine HIV Testing in Nairobi, Kenya: A Feasibility Study. *JAIDS Journal of Acquired Immune Deficiency Syndromes*, **84**, 5-9. https://doi.org/10.1097/QAI.0000000000002317

[16] Kim, A.A., Behel, S., Northbrook, S. and Parekh, B.S. (2019) Tracking with Recency Assays to Control the Epidemic: Real-Time HIV Surveillance and Public Health Response. *AIDS* (*London*, *England*), **33**, 1527-1529. https://doi.org/10.1097/QAD.0000000000002239