HIV single staging algorithm: Integration and maximization of resources by reducing time between HIV diagnosis and treatment

Berry Bennett*, Bonnie Hardy, Sally Fordan, Lizzette Haddock-Morilla, Marie-Claire Rowlinson, Susanne Crowe

Bureau of Public Health Laboratories, Division of Emergency Preparedness and Community Support, Florida Department of Health, Jacksonville, FL, USA

**Article Info**

**Abstract**

**Background:** Early HIV diagnosis, linkage and engagement into care are vital to improved personal health outcomes. The initiation of antiretroviral therapy, with retention in care and drug adherence leads to viral load suppression, a significant decrease in HIV transmission rates and ultimately a reduction in HIV incidence rates. In the U.S only 51% of those diagnosed with HIV infection are retained in care and 28% have a suppressed viral load. Reducing the time and number of visits from HIV diagnosis to entry into care, has the potential to engage and treat an increased number of infected individuals.

**Objective:** (1) Evaluate the feasibility of conducting HIV-1 supplemental testing concurrently with baseline clinical management testing; (2) to evaluate whether all tests could be completed and reported prior to the traditional posttest counseling appointment; (3) to monitor the return activity for posttest and medical provider appointments.

**Methods:** Baseline CD4 and HIV-1 viral load tests were performed concurrently with an HIV-1/2 antibody immunoassay (IA) and HIV-1 Western blot (WB) on 105 individuals with preliminary positive rapid test results. Participating study-sites were located in high-risk, high-morbidity locations: a county jail, a county mobile unit and a county hospital emergency department. Based on the individual’s self-reporting statement of “No” to a previous HIV diagnosis and the POC preliminary positive rapid test result, blood specimens were processed via the Single Staging Algorithm. Study site data and medical record review established time intervals between the rapid test and subsequent visits.

**Results:** Of the 105 individuals with HIV-1 preliminary positive rapid test results, 102 were confirmed positive with HIV-1 WB (plus 3rd generation IA repeatedly reactive) and one was confirmed by an HIV-1 WB indeterminate (gp160), HIV-1 Nucleic Acid Amplification Test (NAAT) reactive (algorithm-defined early infection). The concordance between POC preliminary positive rapid tests and the confirmatory test of the single staging algorithm was 98%. Ninety-six (91%) HIV-1 baseline viral load test results and 82 (78%) CD4/CD8 absolute counts were performed and made available to the provider prior to posttest counseling. The average number of visits for posttest counseling at 14 days was 44.7% (range 37.9–56.5%) with an additional 31.1% (range 27.7–37.9%) returning within 30 days. The average number of clients that returned for the medical provider appointment was 55.4%.

**Conclusion:** A high percentage of HIV-1 clinical management baseline results (78–91%) and 100% confirmatory diagnostic results were completed and reported prior to the traditional posttest counseling appointment. Additional data and analysis is needed to determine the impact of the Single Staging Algorithm on medical provider appointments if the posttest appointment is more than 30 days after the preliminary HIV diagnosis.

© 2013 Elsevier B.V. All rights reserved.

### 1. Background

Early HIV diagnosis, linkage and engagement into care are vital to improved personal health outcomes [1–3]. The initiation of antiretroviral therapy, with retention in care and drug adherence leads to viral load suppression, a significant decrease in HIV transmission rates and ultimately a reduction in HIV incidence rates [1,4,5].
The overarching National HIV/AIDS Strategy Target for 2015 is to reduce HIV incidence in the United States by 25 percent [6]. However it is estimated that only 51% of known HIV-infected individuals are retained in care and only 28% of those individuals have a suppressed viral load [7]. New and proposed HIV diagnostic algorithms provide the ability to detect early as well as chronic HIV infections and can expedite the test-to-treat process [5]. These newer algorithms can be further advanced by including HIV-1 clinical management baseline testing on newly diagnosed individuals using a proposed Single Staging procedure.

2. Objective

This prospective public health study had three objectives: (1) to evaluate the feasibility of conducting HIV-1 supplemental testing (Western blot) and HIV-1 and clinical management baseline testing (CD4/CD8 and HIV-1 viral load) following a point-of-contact (POC) HIV-1 preliminary positive rapid test; (2) to complete testing and ensure that all results were reported to the participating provider within 14 days, the traditional posttest counseling appointment; (3) to examine the client return activity for posttest and the first medical provider appointment to determine if expedited testing is warranted.

3. Methods

3.1. Study design

From November 2009 to July 2011, blood specimens from 105 individuals were submitted to the Florida Bureau of Public Health Laboratories (FBPHL) for diagnostic supplemental testing and clinical management baseline testing. Participating study sites (3) were located in high-risk, high-morbidity areas for HIV infections: a county jail, the emergency department at a county hospital and a large community based organization’s mobile unit. The study sites submitted EDTA plasma and EDTA whole blood from individuals with single or dual reactive POC rapid test results. The individuals were informed at the pretest appointment of their preliminary positive rapid test result and that the confirmatory result would be available within two weeks, i.e. posttest appointment. Based on the individual’s statement (self-reporting) of “No” to a previous HIV diagnosis and the POC rapid preliminary positive result, blood specimens were processed as outlined with the proposed Single Staging Algorithm (Fig. 1). Retrospective database and medical record review established the time intervals between (1) the POC preliminary positive HIV test and the client return (posttest) for HIV-1 confirmatory and clinical baseline results and (2) posttest and the return appointment to see the medical provider. Each appointment was scheduled 14 days apart with the intent that each patient would see the medical provider within 30 days following the preliminary positive rapid test. The retrospective data analysis established the mean time between preliminary HIV diagnosis by a rapid test and entry into medical care based on medical record review.

3.2. Single staging algorithm (Fig. 1)

At the Florida Bureau of Public Health Laboratories, Jacksonville (FBPHL), baseline CD4/CD8 Immunocytometry (Becton Dickinson FACSCount®, San Jose, CA) and HIV-1 viral load (Siemens Versant® HIV-1 RNA, Los Angeles, CA) tests were performed concurrently with an FDA approved 3rd generation HIV-1/2 antibody immunoassay (IA) (Bio-Rad Laboratories, Redmond, WA) and an FDA approved HIV-1 Western blot (Bio-Rad Laboratories, Redmond, WA), provided an adequate specimen volume was received and specimen collection guidelines were followed. CD4/CD8 baseline testing required an EDTA whole blood specimen to be processed and tested within 48 h of collection. An EDTA plasma specimen was
also required to perform the HIV-1/2 diagnostic serology and HIV-1 viral load baseline testing. It was also recommended that EDTA blood specimens collected for confirmatory and viral load testing be centrifuged within 4–6 h of collection and frozen at −20 °C until prepared for delivery to the state public health laboratory. The participating sites were located in close proximity to the state laboratory and freshly collected blood specimens were hand delivered to the laboratory.

4. Results

Of the 105 individuals with HIV-1 preliminary positive rapid results, 102 were repeatedly reactive on the HIV-1/2 Plus O EIA and were HIV-1 WB positive. One additional individual was repeatedly reactive on the HIV-1/2 Plus O EIA, WB indeterminate (gp160) and an HIV-1 viral load of 1,744,400 RNA copies/ml blood. The concordance between the POC preliminary positive rapid test(s) and the supplemental test of the Single Staging Algorithm was 98% (103/105). A high positive predictive value (PPV) for the selection of a rapid test combined with the intended test population is essential to avoid unnecessary HIV clinical baseline testing when testing is performed concurrently. Ninety-six (91%) baseline HIV-1 viral loads and 82 (78%) baseline CD4/CD8 absolute counts were performed and made available to the provider prior to posttest counseling. Only nine (8.5%) specimens for HIV-1 viral load testing and 23 (22%) for CD4/CD8 testing were not performed due to incorrect specimen submission or insufficient specimen volume. The collaboration between the laboratory and POC staff proved to be essential for the proper specimen collection, storage and transportation.

The mean number of client return visits for posttest counseling at 14 days was 44.7% (range of 37.9–56.5%) with an additional 31.1% (range 22.7–37.9%) returning within 30 days. Overall 24.2% did not return for confirmatory and clinical management baseline results or returned after 30 days, indicating that 75.8% were linked to care within 30 days of the preliminary HIV diagnosis. A subsequent appointment provided the client access to a medical provider. The mean number of client return visits for the medical provider (2nd) appointment was 55.4% (Fig. 2).

5. Discussion

At the time of this study our public health laboratory utilized the conventional HIV Diagnostic Algorithm (1989) [8], an FDA approved 3rd generation HIV-1/2 antibody screening test followed by an FDA approved HIV-1 Western blot as the primary supplemental test in the confirmatory process. Even with the conventional algorithm we were able to complete diagnostic testing and clinical baseline testing as described in our objective because of our high daily testing volume and the frequency of performing these tests. The conventional diagnostic algorithm combined with a smaller test population may prove to be problematic in providing all results within the traditional posttest scheduling (14 days). However, the proposed new HIV Diagnostic Algorithm [9] has the potential to reduce diagnostic reporting turn-around-time significantly. Since this study was completed, our public health laboratory has transitioned to the new HIV Diagnostic Algorithm; an FDA approved 4th generation HIV-1/2 antigen/antibody (Ag/Ab) immunoassay followed by an FDA approved supplemental differentiation assay. In addition, we use an FDA approved qualitative HIV-1 NAA T to resolve discordant algorithm results. In our laboratory, after transitioning to the new algorithm, the percentage of HIV-1 positive results reported in ≤2 days is 96%, whereas with the conventional algorithm only 22% of HIV-1 positive antibody results were reported in ≤2 days. It is anticipated that future revisions to the HIV Single Staging Algorithm will use immunoassays proposed in the new HIV Diagnostic Algorithm. In addition it will include baseline HIV-1 genotyping and laboratory access to select databases to verify the client’s self-reported HIV status prior to the preliminary positive result.

New U.S. Department of Health and Human Services (DHHS) Standardized Core HIV Indicator guidelines have redefined linkage to care to be a routine medical visit within the first 90 days after HIV diagnosis [10]. The national estimate as of 2010 for individuals who were aware of their infection and were linked to HIV care was 77%, regardless of the time interval for linkage [7]. In our study 75.8% were defined as linked to care provided the medical provider appointment was achieved within 30 days of the preliminary HIV diagnosis. (Fig. 3) The Single Staging Algorithm has the potential to eliminate an appointment where the newly diagnosed individual would be subject to additional blood draws and verification of Ryan White eligibility but not necessarily be assessed by a clinician for antiretroviral therapy; if warranted. Expedited clinical baseline testing is not the only factor in improving client return rates. Skilled and empathetic counseling coupled with expedited Ryan White eligibility reviews, if needed, can have a direct bearing on the client’s desire for follow up care [11]. Our study defines retention in care as a subsequent medical provider appointment within the study period and was estimated to be 55.4% by comparison to the 2010 national estimate of 51% [7] (Fig. 3). The primary limitation of the study analysis is that the medical record review for return appointments was discontinued eight months after the last study enrollee’s initial HIV test. It is also important to note that the high-risk, high-morbidity study population of 105 presumptive newly diagnosed individuals is too small to generalize our linkage and retention in care rates to other populations.
6. Conclusions

The Single Staging Algorithm concept provided a high percentage of HIV-1 clinical management baseline results (78–91%) as well as confirmatory diagnostic results (100%) to the healthcare provider within 14 days of the initial client visit. The collaboration between the laboratory and POC staff proved to be essential for the proper specimen collection, storage and transportation. The mean number of client return visits for posttest counseling (1st appt.) was 75.8% (defined in this study as within 30 days of the preliminary HIV diagnosis). The ability to provide diagnostic confirmation of a new HIV-1 infection and HIV-1 clinical management baseline results at posttest has the potential to encourage clients to seek medical care at posttest or soon after. The mean number of client return visits for the medical provider appointment (2nd appt.) was 55.4% (defined in this study as retention in care). Additional data and analysis is needed to determine the impact of the Single Staging Algorithm on medical provider appointments if the initial appointment (posttest) is more than 30 days after the preliminary HIV diagnosis.

Integration of laboratory and clinical management testing services presents an opportunity to implement “treatment as prevention” [12]. Successful antiretroviral therapy will reduce the viral load and decrease the likelihood of transmission of HIV and ultimately HIV incidence [7,11,12].

Funding

Research conducted with routine general revenue and HIV Prevention grant funds, no outside government funding.

Competing interests

The authors declare no financial or other conflict of interest.

Ethical approval

All routine prospective HIV related testing performed with FDA approved methodologies with client informed consent. The retrospective medical record review was restricted to the number and frequency of follow up visits with the healthcare provider.

Acknowledgements

We wish to acknowledge the following persons for their assistance in medical record reviews, protocol implementation and training: Joseph Mims, Lolita Hill and Angela Dickinson from the participating clinical and non-clinical sites, Max Wilson, Mitch Marcus and David Andress from the Duval County Health Department, and Marlene Lalota and Tom Bendle from the HIV/AIDS and Hepatitis Prevention Program, Florida Department of Health.

References

[8] Centers for Disease Control and Prevention. Interpretation and use of the western blot assay for serodiagnosis of human immunodeficiency virus type 1 infections. MMWR 1989;38(July (5-7)).