

**Analysis of the March 6, 2000 Performance Evaluation
HIV-1 p24 Antigen Testing Results
Reported to the Centers for Disease Control and Prevention
by Laboratories Participating in the Model Performance Evaluation Program**

This report is an analysis of results reported to the CDC by laboratories participating in the MPEP after they performed p24 antigen determinations on HIV-1 performance evaluation samples shipped to them March 6, 2000. Testing results were reported by 171 (93%) of the 184 laboratories that received sample panels.

Samples used in the MPEP HIV-1 p24 antigen performance evaluation survey are plasma obtained from single donors who are HIV-1 infected or uninfected and are not diluted or pooled with plasma from other individuals. In order to obtain the volumes of plasma required for this performance evaluation survey, plasma units obtained sequentially from an individual donor are combined to obtain the final product. Before shipment, the CDC tested the final plasma product from each donor with two p24 antigen test kits, which are approved by the Food and Drug Administration (FDA).

Table 1 lists the panel and vial designations, the CDC donor numbers, CDC test results, donor HIV status, and a section where laboratorians can insert their test results to compare with the CDC test results.

Table 2 lists the CDC panels for this shipment, the labeled vials contained in each panel, the CDC donor numbers, the CDC test results obtained with each test kit manufacturer, and the CDC interpretation of the results based on the manufacturers' criteria. HIV-1 p24 antigen was detected in the plasma from both of the HIV-1 infected donors (Donors 3 and 4) by each of the test kits used, and the CDC interpretation for these donors was positive for p24 antigen. The plasma from the HIV-1 uninfected donors (Donors 1 and 2) had no HIV-1 p24 antigen detected, as defined by the test kit manufacturers' criteria, and the CDC interpretation for these donors was negative for p24 antigen.

Summary of Results

Figure 1 shows the cumulative frequency of HIV-1 p24 qualitative and neutralization test results reported by laboratories for HIV-1 infected donors (Positive) and for those donors not infected with HIV-1 (Negative).

Qualitative Test. For the 501 results reported for samples from donors that were infected with HIV-1 (Donors 3 and 4), five (1.0%) results did not indicate detection of HIV-1 p24 antigen in these HIV-1 infected donors. For the 336 results reported for samples from the donors not infected with HIV-1 (Donors 1 and 2), only one (0.3%) result indicated the detection of HIV-1 p24 antigen in these HIV-1 uninfected donors.

Neutralization Test. Of the 496 results reported for the HIV-infected donor samples in which p24 antigen was detected by qualitative tests, only 205 (41.3%) of these results were confirmed with a supplemental p24 antigen neutralization test. The presence of p24 antigen was confirmed in 203 (99.0%) of these 205 sample testing results, and two results were reported as indeterminate. Four laboratories reported five p24 antigen neutralization results on samples that were negative for p24 antigen in the qualitative tests. The laboratories that did perform neutralization tests for the p24 antigen-negative samples in their panel reported three negative, one indeterminate, and one positive neutralization test result.

Data is excluded from laboratories that did not provide absorbance values and/or percent neutralization data for negative donor samples, but still reported negative neutralization test interpretations for these samples.

Types of Laboratories Performing HIV-1 p24 Antigen Determinations

The types of laboratories reporting results for the qualitative, neutralization, and quantitative tests are shown in Figure 2. Each laboratory type is listed by decreasing frequency. Blood Bank laboratories performed the most qualitative and neutralization tests while independent laboratories reported the most quantitative test results.

Combination of HIV-1 p24 Antigen Tests Performed

The combination of tests performed by laboratories to determine and confirm the presence of p24 antigen is shown in Figure 3. Of the 171 laboratories reporting results in this survey, 98 (57.3%) reported only qualitative test results. Fifty-eight (33.9%) reported both qualitative and neutralization test results. The remaining 15 laboratories (8.8%) reported results using various combinations of tests.

Types of Test Kits Used

The types of test kits used by laboratories reporting HIV-1 p24 antigen test results are shown in Figure 4, by test type and manufacturer. Test kits approved by the FDA (Abbott and Coulter) were used by 94% of the laboratories reporting qualitative results.

HIV-1 p24 Antigen Qualitative Test Results by Kit Manufacturer

Among the 336 interpretations reported for the p24 antigen-negative samples (Donors 1 and 2) there was only one false-reactive interpretation reported for the sample provided by Donor 1, using the Coulter p24 Antigen Assay (Figure 5).

Of the 501 interpretations reported for the p24 antigen-positive samples (Donors 3 and 4) there were five non-reactive interpretations reported by three laboratories. Three of these non-reactive

interpretations were reported for Donor 4. Three non-reactive interpretations were reported by one laboratory using the Coulter HIV-1 p24 Antigen Assay, and two were reported by two laboratories using the Abbott HIVAG-1 Monoclonal kit. These two laboratories reported Donor 4 samples initially reactive, but non-reactive on repeat testing.

HIV-1 p24 Antigen Neutralization Test Results by Manufacturer

Three laboratories reported neutralization results on four samples that were reported non-reactive in p24 antigen qualitative assays (Figure 6). It is unclear why laboratories would attempt to report neutralization test results on these samples. Additionally, one laboratory performed neutralization testing on a sample for which it had reported a reactive interpretation for the p24 antigen assay, and then reported a negative neutralization result. In Figure 6, data are not included from laboratories that did not provide absorbance values and/or percent neutralization values for the p24 antigen-negative panel samples (Donors 1 and 2) but reported negative neutralization test interpretations for these samples.

Of the 205 neutralization test interpretations reported for the p24 antigen-positive samples (Donors 3 and 4) two laboratories reported two indeterminate interpretations with samples from Donor 4 in their panels. Both had reported reactive results using the Abbott HIVAG-1 Monoclonal kit, and indeterminate results using the Abbott HIVAG-1 Monoclonal Blocking Antibody kit.

Aggregate Percent Neutralization Results Reported by Donor

Aggregate percent neutralization results for HIV-1 infected Donor 3 (duplicate samples) and Donor 4, by test kit, are shown in Table 3. Information listed in these tables also includes the identity of panel vials containing plasma from these donors. For this shipment, Donor 3 provided duplicate samples for each panel allowing participant laboratories the opportunity to review their intra-shipment reproducibility for that donor sample.

Please note that in Table 3 the columns under each donor sample list, by test kit manufacturer, the test interpretation, number of laboratory results for each interpretation, and the minimum, median, and maximum percent neutralization values determined from the data provided by reporting laboratories for each donor sample.

A comparison of the median percent neutralization values determined from the results reported for the duplicated Donor 3 samples in each panel reflects a strong degree of reproducibility in determining percent neutralization by each manufactured kit. With the exception of two reports from laboratories using the Abbott Blocking Antibody reagents, p24 antigen confirmation was correctly reported for samples from HIV-1 infected Donor 3 and 4.

Aggregate p24 Antigen Quantitation Results Reported by Donor

Aggregate p24 antigen quantitation data for HIV-1 infected Donor 3 (duplicate samples) and Donor 4, by test kit, are shown in Table 4. Information listed in these tables also includes the identity of panel vials containing the plasma from these donors. For this shipment, Donor 3 was the only sample that was duplicated in each panel providing participant laboratories the opportunity to review their intra-shipment reproducibility for that donor sample.

In Table 4, the columns under each donor sample list, by test kit manufacturer, the number of laboratory results reporting the quantity of HIV-1 p24 antigen detected, followed by the values for minimum, median, and maximum quantity of p24 antigen, as determined from the results reported.

The range in the quantity of p24 antigen detected, as determined from the results reported for these donors, varied depending on which manufactured reagents were used. The median p24 antigen concentration for duplicate Donor 3 samples in each panel, as determined from participating laboratory results, reflects a good reproducibility in the quantitation of p24 antigen using reagents from any of the individual manufacturers.

Use of Quality Control Testing Material

Information was collected on the use of quality control (QC) samples in addition to the controls contained in the test kits. Depending on the manufactured test kit used, positive and negative test controls, test standards, and/or test calibrators are internal kit control samples used to validate a test run and to determine percent neutralization or quantitate HIV-1 p24 antigen. However, these internal kit control samples may not be sufficient to validate the analytic testing process which may include testing problems related to pipetting, inadequate incubation conditions, inadequate washing, or variability in kit lot sensitivity.

Among the 165 reports of qualitative test results, 121 (73.3%) indicated that external QC was used in addition to manufacturers' test kit controls. Of these 121 reports, 101 (83.5%) indicated the use of commercially manufactured QC samples in addition to kit control samples. Additionally, of these 121 reports, 66 (54.6%) indicated that both positive and negative p24 QC samples were used, while 63 (52.1%) reports indicated the use of QC material with each set/run of plates.

Of the 69 reports from laboratories providing neutralization test results, only 22 (31.9%) indicated that external QC samples were used. The majority of these indicated the use of a commercially obtained p24 antigen-positive QC sample with each plate.

Among the 14 reports received from laboratories performing p24 antigen quantitative tests, eight (57.1%) indicated using external QC samples. The majority described the use of commercially obtained p24 antigen-positive samples with each plate.

Conclusion

The results of this performance evaluation survey for HIV-1 p24 antigen determinations showed that most laboratories correctly detected HIV-1 p24 antigen in those samples from HIV-1 infected donors. Only one laboratory detected HIV-1 p24 antigen in a sample from a donor not infected with HIV-1, resulting in an overall analytic specificity of 99.7% for the qualitative assay results reported for this survey. From the results reported for the p24 antigen-positive samples of donors infected with HIV-1, the overall analytic sensitivity of the qualitative test for this survey was 99.0%. This is in contrast to the September 1999 survey, where the overall sensitivity for the qualitative assay was 77.1%. The donor samples for this survey were the same as the donor samples used in the September 1999 survey, except that the overall sensitivity for this survey was increased. In the September 1999 survey, the false-negative error rate determined from results reported by laboratories using the Abbott HIVAG-1 Monoclonal p24 antigen assay was 34.2%, while in the present survey, the false-negative error rate from results reported by laboratories using the Abbott assay is 0.6%.

The overall analytic sensitivity determined from the results reported for the neutralization test was 99.0% as a result of two indeterminate neutralization test results for samples from an HIV-1 infected donor.

As calculated from the data obtained in this performance survey, the overall analytic performance of laboratories testing these samples for the presence of HIV p24 antigen was 99.3% for the qualitative screening assay and 98.1% for the supplemental neutralization test.

Please note that the next MPEP HIV-1 p24 antigen performance survey panels will be mailed to participating laboratories on September 11, 2000.