Multi-site laboratory evaluation of a dual HIV/syphilis point-of-care rapid test for simultaneous detection of HIV and syphilis antibodies

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This study was a multi-site laboratory evaluation of a dual HIV/syphilis point-of-care rapid test using previously characterized sera from six countries around the world. The sensitivity and specificity of the Duo test were consistently high across sites.

Summary

This study was a multi-site laboratory based evaluation of the performance of SD BIOLINE® HIV/Syphilis Duo test using previously characterized sera from six countries around the world. The sensitivity and specificity of the Duo test were consistently high across sites.

Methods

Study Sites and Population

A total of 6 study sites around the world participated in the evaluation study from 2012 to 2013: laboratories in Ghana, Togo, Kenya, Myanmar, Laos, and Vietnam. Specimens included stored sera which had previously been tested for syphilis and HIV infection according to local guidelines.

Test for Evaluation

The SD BIOLINE® HIV/Syphilis Duo rapid point-of-care test uses a solid phase immunochromatographic assay to detect IgG, IgM and IgA antibodies to HIV specific antigens (HIV-1 gp120, sub O, HIV-2 gp36) and recombinant Treponema pallidum antigens (17KDa) in human serum. The recombinant HIV-1/2 antigen – colloidal gold conjugate, recombinant Treponema pallidum antigens – colloidal gold conjugate, the specimen sample and sample diluents move along the membrane chromatographically to the test region and form a visible line as the antigen-antibody-antigen gold particle complex forms.

Comparison Testing

For gold standard testing each country used a combination of Treponema pallidum particle agglutination assay (TPPA) or Treponema pallidum Hemagglutination Assay (TPHA) and Rapid plasma reagent (RPR) for detection of syphilis infection and enzyme immunoassay (EIA), Western Blot, and rapid tests for the detection of HIV infection. The exact tests used for characterization of serum samples are displayed in Table 1.

Data analysis

We calculated the sensitivity and specificity of test performance at each individual site using the exact binomial method to calculate 95% confidence intervals (CI). Analyses were conducted using SAS v9.3 (Cary, NC).

Results

• Summarized results for each study site for HIV 7, syphilis antibody test performance can be seen in Table 2a and Table 2b.

• In total 2016 HIV characterized specimens and 2009 syphilis characterized specimens were used to evaluate this HIV/Syphilis Duo kit across the six countries.

• The combined sensitivity and specificity for testing HIV status was 99.91% (95% CI: 99.51%, 100%) and 99.67% (95% CI: 99.16, 99.91%), respectively. For the detection of antibodies to syphilis, the combined sensitivity and specificity was 99.67% (95% CI: 98.82, 99.96%) and 99.72% (95% CI: 99.29, 99.92%), respectively.

Background

Syphilis is a curable disease, yet an estimated 1.4 million pregnant women are syphilis infected each year. Recently the World Health Organization (WHO) has called for the dual elimination of MTCT HIV and syphilis.

Screening for HIV and syphilis is highly recommended as part of a comprehensive dual elimination strategy.

The advent of integrated dual diagnostic tests for HIV and syphilis could provide a major breakthrough, facilitating integration of screening of syphilis into HIV prevention programs such as prevention of MTCT of HIV and targeted screening for high-risk populations.

Test developers have created rapid tests that can detect multiple infections in the same sample using a single device. The SD BIOLINE HIV/Syphilis Duo test [17] is a qualitative detection method using a solid phase immunochromatographic assay.

This study was a multi-site laboratory-based evaluation of the performance of the SD BIOLINE HIV/Syphilis Duo test using previously characterized serum samples from six countries.

Table 2a. Laboratory performance for detection of HIV antibodies using a dual SD BIOLINE HIV/syphilis test in previously characterized sera samples in 6 laboratory sites.

<table>
<thead>
<tr>
<th>Country</th>
<th>Test</th>
<th>N</th>
<th>Positive Predictive Value</th>
<th>Negative Predictive Value</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ghana</td>
<td>HIV</td>
<td>241</td>
<td>99.67% (95% CI: 99.20%, 99.98%)</td>
<td>99.91% (95% CI: 99.51%, 100%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Togo</td>
<td>HIV</td>
<td>400</td>
<td>99.91% (95% CI: 99.51%, 100%)</td>
<td>99.67% (95% CI: 99.16, 99.91%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kenya</td>
<td>HIV</td>
<td>527</td>
<td>99.91% (95% CI: 99.51%, 100%)</td>
<td>99.67% (95% CI: 99.16, 99.91%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Myanmar</td>
<td>HIV</td>
<td>591</td>
<td>99.91% (95% CI: 99.51%, 100%)</td>
<td>99.67% (95% CI: 99.16, 99.91%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laos</td>
<td>HIV</td>
<td>149</td>
<td>99.91% (95% CI: 99.51%, 100%)</td>
<td>99.67% (95% CI: 99.16, 99.91%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vietnam</td>
<td>HIV</td>
<td>132</td>
<td>99.91% (95% CI: 99.51%, 100%)</td>
<td>99.67% (95% CI: 99.16, 99.91%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2b. Laboratory performance for detection of syphilis antibodies using a dual SD BIOLINE HIV/syphilis test in previously characterized sera samples in 6 laboratory sites.

<table>
<thead>
<tr>
<th>Country</th>
<th>Test</th>
<th>N</th>
<th>Positive Predictive Value</th>
<th>Negative Predictive Value</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ghana</td>
<td>Syphilis</td>
<td>152</td>
<td>99.91% (95% CI: 99.51%, 100%)</td>
<td>99.67% (95% CI: 99.16, 99.91%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Togo</td>
<td>Syphilis</td>
<td>149</td>
<td>99.91% (95% CI: 99.51%, 100%)</td>
<td>99.67% (95% CI: 99.16, 99.91%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kenya</td>
<td>Syphilis</td>
<td>132</td>
<td>99.91% (95% CI: 99.51%, 100%)</td>
<td>99.67% (95% CI: 99.16, 99.91%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Myanmar</td>
<td>Syphilis</td>
<td>132</td>
<td>99.91% (95% CI: 99.51%, 100%)</td>
<td>99.67% (95% CI: 99.16, 99.91%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laos</td>
<td>Syphilis</td>
<td>132</td>
<td>99.91% (95% CI: 99.51%, 100%)</td>
<td>99.67% (95% CI: 99.16, 99.91%)</td>
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<tr>
<td>Vietnam</td>
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<td>132</td>
<td>99.91% (95% CI: 99.51%, 100%)</td>
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</tbody>
</table>

Discussion

We completed a study combining laboratory performance evaluations from six different laboratories across the world. The sensitivity and specificity of the dual HIV/syphilis test using serum was consistently high across sites.

Point-of-care tests can result in accelerated linkage to treatment and care by decreasing the time to result and can be used in settings with limited laboratory access.

Dual rapid tests with multiple analytes provide additional advantages by testing for multiple infections and there is further efficiency in using a single device and a single specimen.

Multiplex diagnostic tests can increase uptake of screening for often ignored infections like syphilis.

These findings of very high performance are consistent with the performance reported for single point-of-care tests for HIV and syphilis.

Other dual rapid tests for HIV and syphilis have been developed and evaluated and are showing promising results, such as the Multiplex Rapid TP/HIV Antibody Test (Medmira, Canada) and the DPP® HIV-Syphilis Assay (Chembio, New York, USA).

This study was conducted in sera in laboratory settings. The test, however, is optimally used as a point-of-care test in whole blood finger stick samples. Additional evaluation should be considered in field settings.

While there were some differences in the gold standard test algorithms, there was no apparent impact on test performance. A major strength of this study was that it showed consistently high performance in all six settings around the world that have differing rates of infection and human antibody profiles.

Acknowledgements

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