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What is Hot in the World of Point of Care Tests for Sexually Transmitted Infections: Self Collection and New Tests

Breakout Session

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I have received funding for research grants and/or have been a lecturer for Becton Dickinson, Gen-Probe Hologic, Abbott Molecular, Roche, Cepheid, and Quidel.
Objectives

1. To discuss and update new POC tests in the pipeline

2. To demonstrate advantages of self-collection and use of different venues for STI testing outside the clinic, or home STI testing

3. To mention impact of POC testing - advantages and barriers
Use of POC in Clinical Settings

• Immediate treatment before patient leaves the clinic; no loss to follow-up

• Impact on disease epidemic?
  – Decrease interval of disease spread

• Impact on behavior?
  – Counseling on risk reduction

• **ASSURED** Criteria
  – When is a test good enough?
WHO ASSURED Criteria for POC Tests

Affordable by those at risk of infection

Sensitive few false negatives

Specific few false positives

User-friendly simple to perform: 3-4 steps, with minimal training

Rapid and Robust
  rapid: to enable treatment at first visit
  robust: no requirement refrigerated storage

Equipment-free easily collected non-invasive specimens, e.g. urine, saliva, vaginal

Delivered delivered to end-users

http://www.who.int/std_diagnostics/about_SD/priorities.htm
New POC tests for STIs

- Chlamydia
- Gonorrhea
- Trichomonas
- Syphilis
- HSV
- HIV

“Near Patient” Test for Chlamydia, Gonorrhea and Trichomonas

GeneXpert® CT/NG, TV Cepheid

Sensitivity: 95-100%
Specificity 99-100%

FDA Cleared: CT/NG, TV; urine, cervical, vaginal swabs
Also cleared for TV for male urine

Xpert Test for CT, NG, and TV

- Gene Xpert can be used for chlamydia gonorrhea and trichomonas (90 min.)
Atlas Genetics io™ System

- Low cost instrument
- All reagents are on the Cartridge
- Ambient storage >12 month shelf-life
- Broad range of clinical sample types
- Disposable cartridge for sample
- Results provided as clear output
- CE Marked (CT); FDA clinical started (CT/NG)
- Electrochemical label released from probe hybridized by nuclease enzyme
Mobi-NAAT Chlamydia Test / PCR Droplet
PCR microfluidic platform / Smartphone

Droplet cartridge platform

C. Chiou and D. J. Shin et al., Biosens Bioelectron, 2013
Novel Diagnostics CT

Hands-on time <2 minutes

Insert chip into device  Transfer sample into chip, start  On-chip DNA purification  On-chip DNA amplification  Detection and result display

<1  <1  2  15  <1

Time to Result <20 minutes

• Sensitivity equivalent to lab qPCR test
• Assay was able to detect <5 EB of *Chlamydia*
• Highly specific to only *Chlamydia* strains
• Preclinical evaluation using clinical samples underway.
OSOM POCT Trichomonas Antigen Test

- Immunochromato-graphic
- TV membrane proteins
- Mouse antibodies
- Latex beads/capillary action

Huppert et al, JCM 2005; STI 2007:

- Sensitivity 83-90%
- Specificity 98-100%

**5**

**POSITIVE**

- A blue Test Line and a red Control Line is a positive result

**NEGATIVE**

- A red Control Line but no blue Test Line is a negative result.
AmpliVue® Trichomonas HDA Assay

1) simple sample preparation with 1-step dilution/heating
2) isothermal DNA amplification of target sequence specific to *T. vaginalis* by Helicase Dependent Amplification
3) lateral-flow strip based colorimetric detection in a self-contained, disposable device. FDA cleared

Sensitivity 100%; specificity 98.2% vs. culture/wet prep. Vs. NAAT PPA: 87.2-90.1%

Gaydos et al. STD 43:369-373, 2016
Clinical performance of the Solana POC Trichomonas Assay from clinician-collected vaginal swabs and female urines

<table>
<thead>
<tr>
<th>Sample</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swabs</td>
<td>89.7%</td>
<td>99.0%</td>
</tr>
<tr>
<td>Urine</td>
<td>100%</td>
<td>98.9%</td>
</tr>
</tbody>
</table>

Compared to NAAT reference

<table>
<thead>
<tr>
<th>Sample</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asym.</td>
<td>100%</td>
<td>98.9%</td>
</tr>
<tr>
<td>Sympt.</td>
<td>98.6%</td>
<td>98.5%</td>
</tr>
</tbody>
</table>

Compared to wet prep/culture

TV prevalence swabs and/or urines 11.5%

Syphilis: Serologic DX requires detection of two types of antibodies

- Non-Treponemal: RPR, VDRL
- Treponemal: FTA-abs, TPPA, Many new automated, POC

- Both test types have imperfect specificity
- Reactive treponemal test cannot distinguish active from inactive infection

VDRL: Venereal Disease Research Laboratory
RPR: Rapid Plasma Reagin
Some Rapid Syphilis Tests

- Available in the U. S. - Immunochromatographic strip tests (ICS)
  - Syphilis Health Check – Trinity Biotech (FDA cleared, CLIA waived)
- Available Internationally
  - SD Bioline Syphilis 3.0 – Standard Diagnostics/ Alere
  - Determine Syphilis TP – Standard Diagnostics/ Alere
- Dual HIV/ Syphilis assays
  - Multiplo TP/HIV – Medmira Inc.
  - DPP HIV/ Syphilis – Chembio Diagnostics
  - SD Bioline HIV Syphilis Duo – Standard Diagnostics/ Alere (WHO Premarket qualified)
  - INSTI™ HIV/Syphilis Multiplex Test - bioLytical
  - OnSite™HIV/Syphilis Ab Combo Rapid Test - CTK Biotech
  - CTK Biotech, Inc.
- mChip Assay
Laboratory evaluations of syphilis rapid POC performance 2010-2014

- Meta-analysis of 33 studies from POCs
  Sensitivity: 75.12% to 83.78% for blood
  75.98% to 92.03% for serum
  Specificity: 98.39% to 99.44% for blood
  92.68% to 98.51% in serum

Bristow et al Sex Health 12: 119-125, 2015
The IsoAmp® HSV Assay (Biohelix Corp)

- FDA-cleared for HSV in genital and oral lesions
- The IsoAmp HSV has a test-to-result time of <1.5 hr.
- Isothermal helicase-dependent amplification (HDA) technique; no nucleic acid extraction
- The rapid and simple characteristics of the IsoAmp HSV assay make it potentially suitable for POC testing

Lemieux et al. Expert Reviews Ltd. 437-443, 2012;
Female Preference for Type Specimen Collection at Home

Self-collected vaginal swabs are acceptable and preferred over urine and cx to women

Use of POC Outside the Clinic

Emergency Department
• 80% of women would “definitely” test themselves at home if a TV test were available OTC

Pharmacy
• Pharmacists are ranked among the most trusted health care professionals; are accessible 24/7

Internet
Iwantthekit Internet Smart Phone
Emergency contraception patients were invited to order a home collection kit for STI testing

Questionnaires for acceptability

**Pharmacy Testing**

<table>
<thead>
<tr>
<th>Acceptability of pharmacy and home based testing</th>
<th>Pharmacy participants N= 38</th>
<th>IWTK participants kit return (N =81)</th>
<th>No IWTK kit return (N=209)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharmacies should offer STI tests</td>
<td>Yes</td>
<td>97%</td>
<td>92.6%</td>
</tr>
<tr>
<td>Likelihood to use Home kit from pharmacy if free or insurance</td>
<td>Very likely</td>
<td>81.6%</td>
<td>80.2%</td>
</tr>
<tr>
<td></td>
<td>Likely</td>
<td>10.5%</td>
<td>18.5%</td>
</tr>
</tbody>
</table>

Sexual Health 12:472-479, 2015
Internet Outside the Clinic: IWTK

- Order a kit on line & select Rx clinic
- Kit mailed to home
- Collect sample at home
- Mail kit to lab
- Text or Email sent for when results are ready
- Password protected account; obtains results on line; attends clinic of choice treatment

www.iwantthekit.org

Since 2004: Screened 7212 Women, 1313 F rectal 3939 Males; 868 M rectal
Women can perform a self TV test at home

Self-testing for *Trichomonas vaginalis* at home using a point-of-care test by women who request kits via the Internet

*Charlotte A. Gaydos*, *Mary Jett-Goheen*, *Mathilda Barnes*, *Laura Dize* and *Yu-Hsiang Hsieh*

**Abstract.** We offered a point-of-care test for *Trichomonas vaginalis* to women via the Internet to determine if it was acceptable to women to perform the test at home. Most of the 102 participants felt that it was easy to collect the specimen, follow the instructions, and read and interpret the results for the trichomonas self-testing assay.
## Trichomonas Home Test Analysis

<table>
<thead>
<tr>
<th>Question</th>
<th>Easy</th>
<th>Somewhat Easy</th>
<th>Not Easy</th>
</tr>
</thead>
<tbody>
<tr>
<td>How easy was it for you to collect the vaginal specimen correctly?</td>
<td>88 (95.6%)</td>
<td>3 (3.3%)</td>
<td>1 (1.1%)</td>
</tr>
<tr>
<td>How easy was it for you to read the test strip and interpret (tell) the result?</td>
<td>84 (91.3%)</td>
<td>6 (6.5%)</td>
<td>2 (2.2%)</td>
</tr>
<tr>
<td>Overall, how easy was it for you to perform the test?</td>
<td>85 (92.4%)</td>
<td>5 (5.4%)</td>
<td>1 (1.1%)</td>
</tr>
<tr>
<td>Do you believe that the rapid trichomonas test result was correct for the sample that you collected?</td>
<td>52 (56.5%)</td>
<td>39 (42.4%)</td>
<td>1 (1.1%)</td>
</tr>
</tbody>
</table>
Key Applications POC Tests

Sexually Transmitted Infections

- Immediate treatment of positive patients
- Expedite appropriate therapy
- Reduce empirical treatment
- Lower risk of antibiotic resistance
- Improve compliance / minimize loss to follow-up
- Decrease forward transmission
- Lower risk of sequelae
- Improve the patient experience
Barriers to Implementation

- Financial viability
- Money for instruments and consumables
- Obtaining CLIA certificate
- Validating the new test(s)
- Policies and procedures (training manuals)
- Operator training (recertification, proficiency)
- Getting results into the EMR (interface- $7K?)
- Space
- Work Flow Disruption
- Billing and Reimbursement
Conclusions

• POCTs in primary/STI care and perhaps outside the clinic have great potential.

• But there are barriers to successful implementation that need to be overcome which can be costly, time consuming, and require learning new skill sets.

• Better POC tests are coming; the future is promising.
We are trying to POINT the WAY for POC Tests

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